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Comments

**Submitted to the
California Department of Water Resources**

**Regarding the
CALIFORNIA WATER POLICY PLANNING PROCESS
and
BULLETIN 160-2003**

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General Comments Regarding the Bulletin 160-2003 Process

The water policy planning process in California is important to the state's people, its economy, and the environment that supports both. Thank you for providing this opportunity for public input.

I would like to review the state's official water planning history briefly, and then comment on some issues DWR may wish to address in future planning efforts.

Let me preface these remarks with a simple statement. Water planners in California face a difficult task. Every major water supply source in California is in a state of "overshoot" in systems terminology. From the "4.4 plan" to the Bay-Delta process, from the East Side of the Sierra to the North Coast, and from the coastal surface waters to the state's critical groundwater supplies, *every* major water system in California is beyond the limits of physical systems and/or legal limits for extraction.

As one of two states that does not systematically manage its critical groundwater resources, water planners must manage with one hand tied behind your back. In addition, Californian's have come to expect below-cost, high-quality, reliable water whether we are in a wet or dry cycle. Many fine people work with you in Sacramento and elsewhere on this challenge, and the comments below are intended to provide support for your efforts to develop a more sound and effective basis for California water policy. My fairly extensive written comments are critical of DWR's past efforts in some respects. They are intended, however, to support the good work of the many dedicated water managers in the state.

I applaud your efforts to open the discussion more broadly throughout the state on water planning. We need to share this policy challenge and work together to address it.

The California Water Plans, and the Planning Process, in the 1900s

California is embarking on the planning process for the first Bulletin 160 *California State Water Plan* in the new millennium. Much has changed since Bulletin 3, the first *California Water Plan*, was released in 1957.¹ In preparing for the new water plan, it seems worthwhile to examine the history and performance of the state's water planning process. For this reason, comments on the Bulletin 160-2003 process begin with an analysis of the policy context.

Water policy, in the minds of those who first developed the state's plans, was essentially a funding and engineering issue. In the words of Harvey O. Banks, Director of the Department of Water Resources, in his letter of transmittal to Governor Knight for Bulletin No. 3, *The California Water Plan*, on May 6, 1957, "The full solution of California's water problems thus becomes essentially a *financial* and *engineering* problem."² The principle policy challenge confronting water managers for most of the 20th century was perceived to be the acquisition of funding to address the "maldistribution" of California's water resources. Engineering would solve the rest.

Funding for water resources management remains an issue in the new millennium, but the cost-effectiveness of the use of those funds is increasingly being scrutinized. Engineering and re-engineering remain a part of the solution to water management, but other, complimentary approaches are increasingly proving to be more cost-effective and appropriate than those employed in the 1900s. Bulletin 160-2003 will need to consider more carefully than in the past the full range of policy tools available to meet policy goals and objectives.

The goals of water policy in California are also evolving, and the underlying logic that framed policy development in the 1900s is shifting rapidly. The goals that planners were seeking to meet in the 1950s have changed. New goals have emerged which will require

much greater attention than has been provided in past water plans. Bulletin 160-2003 must begin with a careful assessment of the societal goals as they presently exist.

The Policy Logic Underlying California Water Planning

Policy is influenced by the ideas and “logic” of its time. Put simply, the “logic” of unending *growth* provided the underpinning for water policy for most of the 20th century. Continuous growth – of population, housing sprawl, pavement, traffic, and water use – was perceived to be both inevitable and good. It was the fundamental notion driving water policy, and water managers were in turn expected to perpetually deliver more reliable high-quality, low-cost water. Supply “augmentation” was synonymous with water planning and policy for most of the 20th century. The task was to continually get more water from some distant source.

As the 1900s came to a close, the logic of perpetual growth was increasingly coming into question. Population growth, sprawl, the loss of agricultural lands and open space, and the congestion that attend growth are no longer perceived as a valid or desirable policy logic. Furthermore, the physical, legal, and politically acceptable options for additional extraction of water in California are severely limited.

A new policy logic defined by stewardship and sustainability is rapidly replacing the growth logic of the 1900s. This shift has profound implications for California water policy and for Bulletin 160-2003. It will drive significant changes in both the planning process and the plan itself. It is for this reason that policy-makers and water managers should look carefully at the lessons learned in the 1900s.

The California Water Plans

The California Department of Water Resources’ official planning process is set forth in a series of State Water Plans issued since the 1950s.³ This analysis is based on the state plans beginning with the first one issued in 1957, Bulletin 3, *The California Water Plan*,

through the most recent publication in 1998 of, Bulletin 160-98, *The California Water Plan Update*.

The “State-Wide Water Resources Investigation” was authorized in 1947, and for ten years, hydrologists, engineers, lawyers, and other experts studied California’s water systems and developed strategies and plans to “control” and “conserve” the state’s waters through “improvements” and “facilities” throughout the state. The term “conserve” of course meant at that time to extract and use, to avoid water “wasting” to the sea.) The investigation sought to determine California’s “present and probable ultimate water requirements, and to formulate plans for the orderly development of the state’s water resources to meet its *ultimate* water requirements.”⁴ The state water planners at mid-century were not only looking to tap *every* source of water in the state, they also planned to import supplies from the Pacific Northwest, Canada, and even Alaska via massive engineering works.

DWR produced, over the ten-year period from 1947 through 1957, three seminal reports or “Bulletins” which continue to frame water planning efforts in the state through the present time.⁵ *Bulletin No.1, Water Resources of California*, was published in 1951. It catalogues the state’s total water resources based on precipitation and runoff for a 53-year period from 1894-95 through 1946-47.⁶ *Bulletin No.1* provides the critical base-line assumptions regarding the total average water supplies available in the state. *Bulletin No.2, Water Utilization and Requirements of California*, was published in 1955. It “comprised determinations of the present use of water throughout the State for all consumptive purposes, and forecasts of *ultimate* water requirements based in general on the capabilities of the land to support further balanced development.”⁷ *Bulletin No.3*, the first *California Water Plan*, builds on the first two reports and comprises the first official State Water Plan. The report “describes a *comprehensive master plan* for the control, protection, conservation, distribution, and utilization of the waters of California, to meet present and future needs for all beneficial uses and purposes in all areas of the State to the

maximum feasible extent.”⁸ Technical feasibility and government financing were the planners’ principle considerations. The vision of DWR is captured in the following statement from the Foreword to *Bulletin No. 3*:

The need for solution of the present and future water problems of California is clear. It is also clear from a study of the past history of water development in the State that the future growth of California will now depend upon *a coordinated state-wide program for water development*.⁹

The planners at mid-century anticipated that their plan would be “substantially altered and improved” over time. They were convinced, however, that the vision and goal of “*complete development*” of the state’s water resources would remain an unchanging constant:

The basic concept of the Plan as a master plan to meet *the ultimate requirements* for water at some unspecified but distant time in the future, when the land and other resources of California have essentially reached a state of complete development, *will remain unchanged*.¹⁰

Ten years later, in the state’s second water plan, and the first of the “Bulletin 160” series, DWR re-validated the “unchanging” concept set forth in 1957:

The basic concept of the plan as a master plan to meet the ultimate requirements for water ... remains unchanged.¹¹

Interestingly, the goal of “complete development” was simply assumed. The idea that within 50 years, the state would question -- and then *reject* -- the notion of “complete development” was not foreseen by these visionaries at mid-century. This shift in *ultimate purpose* has posed a major challenge to the water planning process and to DWR as an institution. The premise and goal of the state water planning process must now be revisited based on this fundamental shift. In fact, the change is long overdue. It has been recognized by DWR in statement in the state water plans, such as the following comment in *Bulletin 160-87*:

California’s water policies are evolving year by year as new statutes, court decisions, and agreements become effective.

Potentially, one of the most far-reaching policies will involve implementation of the Public Trust Doctrine, which provides that water rights decisions made years ago can be revised by regulatory bodies and the courts, in light of new conditions.¹²

In some important respects, *Bulletin No.3* was modest. Water planners in the post-war era had much larger ideas than are reflected in the first state water plan. They envisioned “augmentation” of the total use of the state’s natural flows with nuclear-powered desalination facilities along the coast and diversions and conveyance of rivers in the northern US, Canada, and Alaska to California. The planning logic that prevailed in the West as DWR developed its state planning process was driven primarily by engineering potential, and water planners were thinking big in this era. The limits of the state’s water resources were seen by some as simply a factor to overcome with additional supplies from other sources. *Bulletin No.3* actually assumed that 5.362 MAFY of Colorado River water (its estimation of California’s “rights” at that time), along with the state’s estimated 71 MAFY of runoff, was “sufficient to provide for the full satisfaction of ultimate water requirements for all areas of the State.”¹³

The Department of Water Resources’ Vision

The vision and plan for developing the state’s water was comprehensive. In his letter of transmittal to Governor Knight in May, 1957, Harvey O. Banks, Director of the Department of Water Resources, clarified the role of the “master plan” to control and utilize the state’s water:¹⁴

Bulletin No. 3 presents a master plan to guide and coordinate the activities of all agencies in the planning, construction, and operation of works required for the control, development, protection, conservation, distribution, and utilization of California’s water resources for the benefit of all areas of the State and for all beneficial purposes.

It is believed that The California Water Plan provides the basis for achieving the most effective and comprehensive development of California’s water resources.

The full solution of California's water problems thus becomes essentially a financial and engineering problem.

Even with the first plan, both DWR and the Board of Engineering Consultants expressed concerns regarding the cost-effectiveness of water development options and environmental impacts. A careful reading of the Bulletins through the years reveals mixed perspectives and notions of what was in the real public interest. The Board of Engineering Consultants (contracted by the department) supported the DWR director and the 1957 plan.¹⁵

The Board of Consultants endorses the principle of long-range planning for *full development and use* of the water resources of California.

At the same time, DWR and the Board expressed concerns regarding appropriate ways to proceed in developing the resources of the state. The Board raised issues in the first state water plan regarding the cost-effectiveness of certain projects. In its report to DWR, it cautioned the department as follows:¹⁶

Bulletin No. 3 includes projects of doubtful economic justification and works of unproven physical feasibility.

The board also supported DWR's concern regarding plans for:

... irrigation of desert areas involving net pumping lifts of several thousand feet *is not now and may never be within the limits of economic justification and financial feasibility.*

And the board endorsed recommendations for further studies which should:

... include determination at then current price levels of: the capital and annual operating cost per acre foot of water for its development and delivery within each hydrographic unit ...

It is significant that the first plan contains explicit statements regarding the cost-effectiveness of certain "facilities" under consideration. The planners, including distinguished engineers, called for a more careful analysis of both technical feasibility and cost-effectiveness. Even with strong political support and the exciting challenges of engineering large and complex systems, they were cognizant of issues that would emerge

more forcefully in coming decades. For example, on page 2 of the Introduction to *Bulletin No.3*, State Water Code Section 105 is quoted with regard to protection of the *public interest* in the development of water resources. The code was cited as follows:

It is hereby declared that the *protection of the public interest* in the development of the water resources of the State *is of vital concern to the people of the State* and that the State shall determine in what way the water of the State, *both surface and underground*, should be developed for the greatest *public benefit*.¹⁷

Bulletin No.3 also makes a key statement with regard to the ultimate construction of facilities. On the first page of the actual plan (Chapter IV, “The California Water Plan” of *Bulletin No.3*) DWR makes the following statement:

The California Water Plan is an *ultimate plan*, designed to meet the water requirements of the indefinite future when the land and other resources of the State are essentially fully developed. *It is fully acknowledged that certain of the forecast requirements for water may never be realized, and that the facilities which would provide for those requirements may never be constructed*.¹⁸

From the outset DWR recognized, for various reasons, that society may choose not to implement the technical options they identified in the plan. *Bulletin No.3* notes that “the planning effort is deemed necessary at this time in order that provision may be made for such development *if and when requirements arise*.”¹⁹ The planners understood that society might choose, for good reasons, to reject elements of the plan.

Throughout the 1900s, the state water planning process failed to include a serious assessment of demand elasticity as a basis for water use. Without a reasonable economic analysis, the actual cost-effectiveness of water projects has not been determined. Though the water planners that developed the first California plan were well aware that cost-effectiveness was a critical consideration for water supply development and for project assessment, the state water plans have never included an analysis of state-wide demand under a full-cost price scenario, or anything remotely resembling full-cost. Instead, the plans have managed to avoid the issue of market signals. It is doubtful that Bulletin 160-2003 will be able once again to assume away the realities of markets. Price does indeed

matter, and “externalities” such as water quality impacts and ecosystem and species impacts are no longer “off book” in the planning process.

The Bulletin 160-2003 planning process would be well served by a full and clear commitment up front to examine future water-use scenarios based on something approximating full-cost pricing. What would farmers grow, and how would they irrigate their crops, and how would industry, institutions, commerce, and residences actually use water, if the price they all pay included its full cost including external impacts? DWR should explicitly ask this question, and then seek to provide answers.

Environmental Values, Present but Overruled

State water planners in the 1950s were also concerned about environmental values. Interestingly, part of their vision was the protection and enhancement of fish, wildlife, and recreational amenities in naturally flowing waters. DWR anticipated in *Bulletin No.3* the need for the provision of in-stream flows for the protection and enhancement of fish and wildlife. It even went so far as to call for legal protection of in-stream flow rights under California law in order to allow for and authorize protection of fish and wildlife and to provide for recreational values. In a key section of *Bulletin No.3* on implementation of the water plan, concern is voiced regarding that legal framework for even allowing, much less mandating, in-stream flows. In its chapter on implementation of the state water plan, DWR makes the following statement:

In order to provide sufficient flowing water in a stream for fish and wildlife and for the enhancement of recreational aspects of a stream, it may be necessary to store water in headwater reservoirs to permit planned releases during low-water periods. The combined releases and natural flows would be planned for a desirable all-year regimen of flow *in the interests of protection and enhancement of fish, wildlife, and recreation.*

DWR then expressed concern regarding the need for legal protection of natural flows and releases from storage facilities in the interest of protecting fish, wildlife, and recreational values. In a clear and thoughtful comment, DWR articulates the need for water rights law

to accommodate in-stream flow for the explicit purpose of protecting these values. It also states clearly the impediment in prior appropriation doctrine to accomplishing this goal:

In order to accomplish the foregoing objectives, the planned stream *flows should be protected against appropriations* of water for other purposes. However, *present law does not provide positive and reliable protection for such natural or unregulated flows* in a watercourse where such flows are not otherwise taken under control. As is elsewhere pointed out, there is no method for broadly reserving unappropriated water from appropriation under the general law pertaining to that subject. Furthermore, continuance of the unobstructed natural flow of a stream probably cannot be assured by making an appropriation of water for that purpose, because an essential element of an appropriation is generally considered to be the exercise of physical control and dominion over an identifiable quantity of water by either diverting it from the stream channel or by artificial regulation of the flow within the channel.²⁰

Bulletin No.3 looked to the Fish and Game Code, Section 525, apparently in *support* of in-stream flow authorization, observing that it “requires the owner of a dam to allow sufficient water to pass the dam to keep fish in good condition below the dam.” But it then notes that the Attorney General (absent a court precedent) had concluded in an opinion, that Section 525:

... is not a reservation of water for the reservation of fish life but is rather a rule for the operation of dams where there will be enough water below the dam to support fish life, i.e., it is a standard for the release of water in excess of what is needed for domestic and irrigation purposes so that what is available for fish life shall not be wastefully withheld.²¹

It seems reasonable to infer from DWR’s comments in *Bulletin No.3* that at least some of the planners who were developing a comprehensive vision for California’s water resources at mid-century were concerned about the *public interest* in the use of surface and groundwater, and that they were interested in protecting environmental values and providing for in-stream flows. These planners anticipated concerns that would emerge in the second half of the century, and that would, by the century, begin to drive key water policy decisions.

In the early 1990s, DWR in *Bulletin 160-93* observed correctly:

Since 1957, when the first comprehensive California Water Plan was published, *attitudes* toward and methods for managing the State's natural resources have gone through many changes. *Californians have become more environmentally sensitive*, as reflected in statutes such as the California Environmental Quality Act, the State Endangered Species Act, and the State Wild and Scenic Rivers Act.²²

Perhaps a more accurate statement would be that California's *institutions*, and in particular DWR, have been *forced* to become more environmentally sensitive through these acts, and other laws at both the state and federal levels, and through court decisions based on them. It is precisely through these policy tools that the in-stream flows discussed in *Bulletin No.3* have been partially re-established. DWR, after all, had acknowledged the changing values of society with regard to environment since its first *Bulletin 160* issued in 1966.

In the mid-1960s, even as the water planners set their sights on rivers to the north, they were already talking seriously about restoration of salmon runs that had been destroyed by over-exploitation of water resources and pollution. In *Bulletin 160-66*, DWR suggests:

There may be an opportunity to rehabilitate and enhance the king salmon run of the San Joaquin River system. Through streamflow augmentation, rejuvenation of stream gravels, removal of vegetation, construction of hatcheries, abatement of damaging water pollution and other measures, it is estimated on a very preliminary basis that salmon runs in the San Joaquin River system, averaging 500,000 fish annually, could be developed by 2020.²³

DWR was well aware in 1970 that public opinion and the politics of environmentalism would impact water policy in a profound way. *Bulletin 160-70* comments on the impact of recent legislation and the impact it would have on water policy:

Both the State Legislature and the Congress have declared the 1970s to be the decade of the environment. This is reflected at the state level in the passage of three significant bills, and at the federal level by enactment or extension of important policy statutes. While

this legislation is somewhat broadly based, *it will profoundly affect future water resource development.*²⁴

DWR paid particular attention to federal legislation: NEPA in 1969, the (federal) Wild and Scenic Act in 1968, and the Water Quality Improvement Act of 1970. *Bulletin 160-70* also notes the Colorado River Basin Act of 1968 (P.L. 90-537) which reflects California's reduced entitlement at 4.4 MAFY.²⁵

In *Bulletin 160-70*, William R. Gianelli, Director of DWR, stated clearly:

The recent emergence of environmental awareness and concerns stems from two major considerations: first, the obvious deterioration of our surroundings today – air pollution, water pollution, debris of our industrial society, urban sprawl, loss of our natural fauna and flora, ecological disruption, and many other distressing aspects of contemporary society; and second, the predictions of what may happen in the future as the population pressures increase, and the related impact of our expanding technological society is intensified. That these problems must be solved within a framework of comprehensive environmental and resources policy is becoming increasingly clear.²⁶

Gianelli and DWR even invoked Governor Reagan's support for environmental concerns:

With the approach of the 1970s, the environment and environmental problems have become the watchword not only of the public but also of the Governor, the executive departments, and the lawmakers.²⁷

Bulletin 160-74 also recognized the shift in public support for environmental quality:

Governing bodies at all levels – Congress, the California Legislature, local boards and commissions – reflected the concern of their constituents in approving CEQA, NEPA, the California Wild and Scenic Rivers Act, the Federal Water Pollution Control Act Amendments of 1972, and resolutions supporting “no growth”.

DWR's analysis was that legal challenges in the courts led to the legislative changes of the 1960s:

Individual members of the public, and various organizations, have also attempted to achieve environmental goals through litigation.

Public appeal to the courts began in the mid-60s. It is generally believed that these early cases spawned the federal and state environmental laws which became effective in the 1970s.

Bulletin 160-2003 must approach environmental issues differently than has been the case in the previous bulletins. Specifically, DWR needs to take full account of the water flows and quality characteristics throughout the state that are required to maintain ecosystems and species in a healthy state. In many cases, this will require the restoration of both ecosystems and species. Though recognized by thoughtful water planners in the mid-1900s, water requirements for environmental systems were generally not mandated or protected, or even supported, by law. Now they are. Indeed, responses to environmental damage is presently a major driver of water policy in the state. Accordingly, DWR should fundamentally change the Bulletin 160 process and examine explicitly the water requirements for ecosystem restoration and maintenance throughout the state. The result will clearly be a reorientation of water planning processes.

A Changing Focus for Planning

In the second half of the 20th century, the focus of water policy and planning in California shifted from supply-side engineering plans to the challenges of managing a limited and over-subscribed resource. Cost considerations and environmental impacts are paramount in current policy discussions, and the need to restore environmental damage and threatened and endangered species is framing water policy and planning processes. The state faces a situation in which *existing* facilities are capable of extracting *more* water than is permitted by legal processes. The state's physical capacity to extract water from the Colorado River, the Mono and Owens watersheds in the Eastern Sierra, the delta, diversions on coastal rivers and other surface waters of the state, and groundwater pumping, are all *limited not by technical capacity* but by deliberate constraints enacted by society through the courts and legislative processes based on strong and enduring values.

The official state water planning process, as reflected in DWR's *Bulletin 160* series, has had difficulty with, or has opposed, changes that have occurred in the water policy context. As DWR states in Bulletin 160-93:

As nearby sources were fully developed, urban areas began to reach out to more distant sources. Local agencies are finding it increasingly difficult to continue to undertake new water projects to meet their needs because potential sites for additional water projects are either environmentally sensitive, too costly, or both.²⁸

Understandably, the state department charged with building and operating the State Water Project (SWP) and providing the “big picture” plans for ambitious water development projects has found the challenges of limiting water extractions and restoring environmental damage difficult to adjust to. The institutional changes taking place are immense. DWR's federal counterparts and sometimes partners, the Bureau of Reclamation and the Army Corps of Engineers, are undergoing similar changes. The Bureau is no longer a “dam building” agency.

The “solutions” to challenges faced a few decades ago are now the “problems” facing society, and the new “solutions” involve a fundamental shift in thinking and policy. The following analysis of the DWR planning process reveals the evolving policy priorities over half a century and a significant change in policy priorities.

California's Water "Plans"

California is presently faced with problems of a highly critical nature – the need for further control, protection, conservation, and distribution of her most vital resource – water. Unless corrective action is taken – and taken immediately – the consequences may be disastrous”

The California water Plan, Bulletin No. 3, 1957 ²⁹

The Bulletin 160 series assesses California's water needs and evaluates water supplies, to quantify the gap between water demands and water supplies.

David Kennedy, Director, DWR, Foreword to *Bulletin 160-98* ³⁰

The California Department of Water Resources (DWR) is the state agency charged with the role of comprehensive, long-term planning for all of the state's water resources. DWR is the lead agency for data and analysis regarding water supplies and use throughout the state, and its reports form the basis for state and local water policy decisions. The agency is also responsible for the construction and operation of the State Water Project (SWP).

Since the 1950s, DWR has issued a series of official state “water plans” which seek to quantify use patterns and forecast future water use and supplies. Known as the *Bulletin 160* series, the documents are now issued every five years as required by state law,³¹ with the most recent being *Bulletin 160-98*.³² The *Bulletin 160* report is the official state planning document and the only planning tool that seeks to include all water systems within the state. It is used as a baseline planning tool for other major water policy processes such as CALFED.

This section examines the DWR *Bulletin 160* series of reports in some detail for two reasons. The first is that the reports provide the only official source of basic data on the state's water resources. The second is that the reports provide the only official California water planning and policy statement, to the extent there is one.

Perpetual Shortage, or a “Longage” of Demand?

Based on reasonable forecasts of growth of the State during the next decade, it is indicated that the net shortage of developed water supply could amount to more than 10,000,000 acre feet per season by 1965, taking into account increasing importations and deliveries from presently developed water sources.

*Bulletin No. 3, 1957*³³

Bulletin 160-98 forecasts water shortages in California by 2020, as did the previous water plan update.

*Bulletin 160-98, 1998*³⁴

These two quotes are taken from the first *State Water Plan* in 1957 and the most recent in 1998. The *Bulletin 160* “plans” have consistently forecast “shortages” and called for the construction of additional “facilities” to meet projected “needs” in the state. David Kennedy’s comment in the foreword to *Bulletin 160-98* – “The Bulletin 160 series assesses California’s water needs and evaluates water supplies, to quantify *the gap* between water demands and water supplies”³⁵ – illustrates the “logic” of shortages and the perpetual “gap” between “needs” and supplies that has become a foregone conclusion.³⁶ *Bulletin 160-93* provides a more explicit statement of the “gap”. In its letter to Mr. Kennedy, the California Water Commission makes clear its agenda: “... there is a serious and long-standing *gap* between planning on the one hand and *construction* and operation of water supply facilities on the other.”³⁷ *Bulletin 160-98* continues the tradition of projecting shortages and then outlining the options for new facilities to build:

*Bulletin 160-98 forecasts increased shortages by 2020 – 2.4 maf in an average year and 6.2 maf in drought years.*³⁸

and, it goes on:

The water management options identified as likely to be implemented could reduce those shortages to 2.0 maf in average years and 2.7 maf in drought years.

The majority of the “water management options” identified in *Bulletin 160-98* are new facilities.³⁹

As planners in the former Soviet Union could explain, shortages are inevitable if prices fail to reflect scarcity value in the market. There will always be a “gap” under these conditions. “Demand” for water, and the anticipated “use” of water, and the “need” for water (the terms are used interchangeably by DWR) have been systematically overstated in the state water plans because they have not been based on a marginal cost analysis. Water “shortages” have been projected in every plan (through *Bulletin 160-98*) based on “demand” forecasts that have projected *trends of water use* in the urban and agricultural sectors *without regard for market signals*. Specifically, the impact of price on demand, or demand elasticity, has not been incorporated into the analysis. Instead, the DWR has consistently forecast shortages based on “use patterns” and called for additional facilities. The latest *Bulletin 160* is no exception, explaining that “shortages represent the difference between water supplies and water demands” without noting that “demand” is a function of price.⁴⁰

The most recent *Bulletin 160* assesses California’s agricultural, environmental, and urban water “needs” and evaluates water supplies *in order to quantify the gap* between future water demands and the corresponding water supplies.⁴¹ The “need” is based on use patterns, not on a market-driven demand function, and the “gap” is based on water use patterns at prices that do not reflect market realities or full costs. Yet the report claims that it cannot present plans to completely eliminate shortages because of “economic realities” (e.g. lack of capital for new supply projects) and because of limited current plans by local agencies.⁴² In short, the “economic reality” is that there is not enough money to build all the projects that would be required to meet “demand” at current below-cost prices. Stated differently, there will always be a “shortage” of undervalued, reliable, high-quality water, and therefore the “gap” will never be closed.

A Consistent Supply-Side “Logic” Unburdened by Market Realities

Bulletin 160-98 references market forces in a number of places, but it consistently and systematically fails to account for markets and price signals in framing *demand* (in the market sense of the term) for water in California. Public comments on the draft Bulletin 160-98 noted this failure to analyze market and price factors. DWR’s response in the final version of the report is instructive. One again, *demand* and *needs* are confused in the analysis:

Some comments suggested that the Bulletin’s water *demands could be reduced by raising water prices*, while others felt that the forecasted demands were too low and did not take into account future *needs* of California’s population and agricultural economy.⁴³

Twenty-five years ago, DWR addressed the role of markets in allocating water with a concise and accurate statement. It then promptly dismissed the use of markets because, it claimed, the legal structure would not accommodate it. Under the heading: “Economic Efficiency as a Basis for Water Management” in *Bulletin 160-74*, DWR observed:

As California’s supplies of undeveloped water have decreased, suggestions have been made that certain presently developed supplies could be diverted from uses having low economic returns to uses with higher economic returns. Generally this would involve a shift from agricultural production to industrial use, as well as a change in geographic location. It also suggests the shifting of water from one crop to another that might use less water and produce more economic return. Advocates of this view point out that there would be greater employment and wealth for a given quantity of water *and there would not be need for as much, if any, additional water development*. This concept also includes the purchase or shifting of water during periods of drought from one use such as irrigation of an annual crop to a use of greater significance to the State’ economy. *Such a concept has great ramifications and raises major policy issues. State law does not provide for administrative reassignment of water supplies being beneficially used.*⁴⁴

Though DWR planners are obviously aware of the role of markets, it has consistently refused to incorporate a serious economic analysis into the planning process. The call for

analyzing price impacts and market signals continues to fall on deaf ears. The response indicates *a failure to delineate the difference* between what some people “feel” the future “needs” might be and the necessity of analyzing price impacts on demand.⁴⁵ In further response to comments on the draft *Bulletin 160-98*, DWR characterizes opposition to the construction of new reservoirs as an “expression of philosophical opposition” while support for them is acknowledged as a recognition of “need”.⁴⁶ A serious cost/benefit analysis might help.

DWR notes the issue of price elasticity and the impact of prices as follows:

The relationship of water pricing to water consumption, and the role of pricing in achieving water conservation, has been a subject of discussion in recent years.⁴⁷

The department then *rejects* the role of price elasticity as a significant factor impacting demand. It bases this position on “several studies” indicating that “price elasticity for urban water use is usually inelastic.”⁴⁸ Both the literature and the experience of water purveyors would tend to indicate that DWR is dismissing pricing and price elasticity too hastily. For agriculture, DWR notes “affordability” problems and reverts to statements of “need” for the sector. Again, there is little question that price elasticity is a significant factor in the selection of crop types, irrigation methods, and other factors strongly affecting amount of water used. The state water plan should reasonably be expected to consider demand scenarios based on price, with at least one scenario at something approximating full-cost pricing.

Bulletin 160-98 reveals DWR’s fundamental “logic” of water “planning” based on politics in the state by explaining that notwithstanding market forces, elected officials seek to keep the costs “affordable” for consumers:

Elected board members of public water agencies have the responsibility for balancing *desires to achieve demand reduction* through water pricing with *desires to provide affordable water rates to consumers*.⁴⁹

This statement captures perfectly the thinking of the former Soviet planners. Water must be kept “affordable” for users, and the “gap” between supply and “demand” (at “affordable” price levels) must be closed with *more projects* and *more government support*. The use of full-cost prices, including an accounting of environmental costs, is rejected, while government financing for more dams is the planning solution.

Accounting for Environmental Costs

The planning process has consistently failed to account for environmental impacts and costs of water extractions from natural systems. As the statement above from *Bulletin No.3* indicates, planners were actually arguing that the dams and diversions they were building were *good* for the environment. In 1987, DWR acknowledged that:

Before 1960, planning for future water allocation and use in California seemed to be a fairly straightforward process. With few exceptions, damming rivers to store water for irrigation, urban uses, and hydroelectric power production was not regarded as having a serious detrimental impact on the environment.⁵⁰

In the early 1960s, relationships between environmental values and water supply became more apparent.⁵¹

DWR has taken recent court rulings and legislation into partial account in the *Bulletin 160* series, but it has failed to provide a basis for water planning that will actually restore ecosystems and avoid continuing problems with threatened and endangered species. In *Bulletin 160-93*, DWR acknowledged (even as it continued to resist) the shift in priorities for water management in California:

Since the last water plan update in 1987, *California Water: Looking to the Future*, Bulletin 160-87, evolving environmental policies have introduced considerable uncertainty about much of the State’s water supply. For example, the winter-run Chinook salmon and the Delta smelt were listed under the State and federal Endangered Species acts, imposing restrictions on delta exports, and the Central Valley Project Improvement Act (PL 102-575) was passed in 1992, reallocating over a million acre-feet of CVP supplies for fish and wildlife. Other actions, such as the State

Water Resource Control Board's Bay-Delta proceedings, and the federal Environmental Protection Agency's proposed standards, *suggest that even more stringent requirements could be imposed.*⁵²

DWR was correct in interpreting these policy signals from the courts and congress as important and lasting changes in the way it conducted its planning. Though the signals from all directions (popular opinion, courts, state and federal legislation) were clear, DWR has failed to adjust its fundamental approach to water planning. Instead, it shifted its *accounting* method in *Bulletin 160-93* to include a new "environmental" category of water use. The approach is muddled and inaccurate as discussed in more detail below. *Bulletin 160-98* reviews the growing list of environmental and ecosystem concerns, adds questionable flow numbers to the confused "environmental" water accounting category, *and then calls for additional extractions* to meet agricultural and urban "needs".

The *Bulletin 160* series has been consistently and seriously flawed. The water "plans" may more accurately be described as expressions of the aspirations of water development interests. The following analysis reviews in detail the water plans, and it then sets forth recommendations for changes.

ANALYSIS OF THE STATE WATER PLANS SINCE 1957

The real issue is the problem of planning adequately for the use of one resource – water – in a near vacuum of other equally controversial and interrelated problems such as population and land use.

*Water for California, Bulletin 160-70*⁵³

Trends in Analysis and Forecasts

An examination of the *State Water Plan* documents reveals important trends and insights into the “logic” that has framed official California water policy for half of the 20th century. The following tables provide a comparison of the water plans and forecasts contained in each of the plans back to *Bulletin No. 3*, the first state water plan completed in 1957. Data was extracted from “net” and “applied” water-use tables depending on the report and its methodology. As discussed below, the methodology has changed over the years, making some comparisons difficult.

Several trends in the state plan series are worth noting. First, the plans have never used a market-based approach to analyze water demand. Instead, DWR has forecast *use*, *requirements*, and *need* without regard for price elasticity, and then it has represented these figures as *demand*. In other words, there has been no systematic analysis of the impact of different price levels on the perpetual “shortage” that has consistently been forecast in each plan. Second, every state plan has forecast a “gap” between forecasted “demand” and available supplies. In turn, each plan has called for the construction of additional facilities to meet “needs” and to avoid catastrophe. Third, the forecasted for water use volumes have *declined* over the years. Water use (actual and forecasted) for agriculture has declined as well. From the 1950s through the 1970s, agricultural uses led the growth forecast, but forecasts for the long term steadily declined. After peaking in the early 1980s, both irrigated land area and agricultural water use began to decline in actual current figures and in long-term forecasts. Within less than 25 years, irrigated acreage had

peaked and started declining. Irrigated acreage in California peaked in the early 1980s at about nine and a half million acres and has been declining since. At its peak, irrigated land area was *less than half* the figure forecasted in *Bulletin 3* for “ultimate” development (19,976,000 acres).

The California Water Project and Plans ⁵⁴

The “California Water Plan” was envisioned from the outset as a “master plan” for a set of “projects” to be built. The role of DWR was to quantify the water in the state (*Bulletin No.1*), and then figure out how to divert and extract as much of it as possible (*Bulletin No.2*). The “water plan updates” are essentially progress reports toward this end. This facilities-based, supply-side approach to “planning” remains the underlying policy logic for DWR and the state water planning process. The following comparisons of the department’s “water plans” reflect the evolving role of the planning process.

The State Water Plans

Titles of the “State Water Plan” Reports	
Year	Title
1957	<i>The California Water Project</i>
1966	<i>Implementation of the California Water Plan</i>
1970	<i>Water for California: The California Water Plan: Outlook in 1970</i>
1974	<i>The California Water Plan: Outlook in 1974</i>
1983	<i>The California Water Plan: Projected Use and Available Water Supplies to 2010</i>
1987	<i>California Water: Looking to the Future</i>
1994	<i>California Water Plan Update</i>
1998	<i>The California Water Plan Update</i>

Sources by report year:

- 1957 California Department of Water Resources, Bulletin No.3, *The California Water Plan*, May 1957.
- 1966 California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March 1966.
- 1970 California Department of Water Resources, Bulletin 160-70, *Water for California*, December 1970.
- 1974 California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974.
- 1983 California Department of Water Resources, Bulletin 160-83, *The California Water Plan*, December 1983.
- 1987 California Department of Water Resources, Bulletin 160-87, *California Water: Looking to the Future*, November 1987.
- 1994 California Department of Water Resources, Bulletin 160-93, *California Water Plan Update*, October 1994.
- 1998 California Department of Water Resources, Bulletin 160-98, *The California Water Plan Update*, November, 1998.

Terms and Categories of “Demand”

The use of water, and the terms used by DWR to describe it, have changed over the past half century. Irrigated agriculture has consistently ranked as the largest use of “developed” or diverted water (ranging from 75% to 85% over the years), followed by “urban” uses which include residential, commercial, industrial, institutional, and other uses. Fish and wildlife, energy facilities, and environment have been listed intermittently in different reports, largely reflecting issues of the time. The terms *use*, *demand*, *requirements*, and *need* continue to be used interchangeably without definition.

Terms for “Demand” and Categories in the Bulletin 160 Reports

Year	Term	Categories
1957	Requirement	Irrigation, Urban/Suburban/Industrial, Miscellaneous
1966	Requirement	Agricultural, Urban, Fish/Wildlife/Recreation
1970	Demand	Agricultural, Urban, Power Plant Cooling
1974	Demand	Agricultural, Urban, Fish/Wildlife/Recreation
1983	Use	Agricultural, Urban, Wildlife/Recreation, Energy Production
1987	Use	Agricultural, Urban, Environmental, Energy Production
1994	Demand	Agricultural, Urban, Environmental, Other*
1998	Use	Agricultural, Urban, Environmental

* “Other” includes: conveyance losses, recreation uses, and energy production

Sources by report year:

1957	California Department of Water Resources, Bulletin 3, <i>The California Water Plan</i> , May 1957.
1966	California Department of Water Resources, Bulletin 160-66, <i>Implementation of the California Water Plan</i> , March 1966.
1970	California Department of Water Resources, Bulletin 160-70, <i>Water for California</i> , December 1970.
1974	California Department of Water Resources, Bulletin 160-74, <i>The California Water Plan</i> , November 1974.
1983	California Department of Water Resources, Bulletin 160-83, <i>The California Water Plan</i> , December 1983.
1987	California Department of Water Resources, Bulletin 160-87, <i>California Water: Looking to the Future</i> , November, 1987.
1994	California Department of Water Resources, Bulletin 160-93, <i>California Water Plan Update</i> , October, 1994.
1998	California Department of Water Resources, Bulletin 160-98, <i>The California Water Plan Update</i> , November, 1998.

Methodology and Scenarios

DWR has employed a variety of inconsistent approaches and methodologies in the California water plan series. One drawback to the ever-changing methodology is that comparison of the plans and data over time is complicated and in some cases impossible. Numerous problems with changing methodology are discussed below.

Methodology of the Bulletin 160 Reports

Year	Scenario Approach
1957	Single scenario of ultimate requirements
1966	Single demand and supply scenario
1970	Single demand and supply scenario
1974	Four demand scenarios and a single supply
1983	Single demand and supply scenario
1987	Single demand and supply scenario
1994	Single demand scenario and two supply scenarios (average and dry year)
1998	Average and Drought Year scenarios

Sources by report year:

1957	California Department of Water Resources, Bulletin 3, <i>The California Water Plan</i> , May 1957.
1966	California Department of Water Resources, Bulletin 160-66, <i>Implementation of the California Water Plan</i> , March, 1966.
1970	California Department of Water Resources, Bulletin 160-70, <i>Water for California</i> , December 1970.
1974	California Department of Water Resources, Bulletin 160-74, <i>The California Water Plan</i> , November 1974.
1983	California Department of Water Resources, Bulletin 160-83, <i>The California Water Plan</i> , December 1983.
1987	California Department of Water Resources, Bulletin 160-87, <i>California Water: Looking to the Future</i> , November 1987.
1994	California Department of Water Resources, Bulletin 160-93, <i>California Water Plan Update</i> , October, 1994.
1998	California Department of Water Resources, Bulletin 160-98, <i>The California Water Plan Update</i> , November, 1998.

Irrigated Area in California: Actual and Forecasted

One of the most dramatic changes in assumptions in the California water plans has been the declining forecast for both irrigated land area and water use. The forecasted irrigated area (figures across the bottom line) show a steady and steep decline over the half-century of plans. Current forecasts are *less than half* the area forecasted in the 1950s. (Total irrigated acreage is forecast to decline by 325,000 acres in the next 25 years.)⁵⁵

Irrigated Land Area in California Actual and Projected Area in DWR Bulletin 160 Series (1,000 acres)								
	<i>Report Year</i>							
	1957	1966	1970	1974	1983	1987	1994	1998
<i>Year Projected</i> (actual figures in bold)								
1950	7,346	--	--	--	--	--	--	--
1960	--	8,085	--	--	--	--	--	--
1967	--	--	8,480	--	--	--	--	--
1972	--	--	--	8,780	--	--	--	--
1980	--	--	--	--	9,490	--	--	--
1985	--	--	--	--	--	9,200	--	--
1990	--	9,564	9,340	9,740	9,850	--	9,178	--
1995	--	--	--	--	--	--	--	9,068
2000	--	--	--	--	10,030	--	--	--
2010	--	--	--	--	10,220	--	--	--
2020	19,176	10,775	9,640	9,850	--	--	8,800	8,635

Sources of figures by report year:

- 1957 California Department of Water Resources, Bulletin 3, *The California Water Plan*, May 1957, page 14, Table 2, (*Bulletin 3* states on page 13 that the "gross" area figure of 7,300,000 acres based on *Bulletin 2* is used, even though "the actual area irrigated, or net area, was about 6,900,000 acres.")
- 1966 California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March, 1966, p. 43, Table 4.
- 1970 California Department of Water Resources, Bulletin 160-70, *Water for California*, December 1970, p.42, Table 2.
- 1974 California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974, p.55, Table 5. (Based on scenario II for 1990 and III for 2020.)
- 1983 California Department of Water Resources, Bulletin 160-83, *The California Water Plan*, December 1983, p. 147, Table 35.
- 1987 California Department of Water Resources, Bulletin 160-87, *California Water: Looking to the Future*, November, 1987, p.9. (No estimates are made for future irrigated land area.)
- 1994 California Department of Water Resources, Bulletin 160-93, *California Water Plan Update*, October, 1994, Vol.1, p.179 for 1990 figure, p.181 for 2020 figure.
- 1998 California Department of Water Resources, Bulletin 160-98, *The California Water Plan Update*, November, 1998, Executive Summary, pp. ES4-8 for 1995 figure, pp. ES4-10 for 2020 figure.

Total "Net" Use Figures for All Extractions Other than Environment

"Net" water use has increased steadily (bold figures), although there are data gaps due to DWR's inconsistent methodology. DWR eliminated the "net" water use analysis in *Bulletin 160-98*. As discussed in further detail below, "net" water use is in some ways a more useful measure of the amount of water extracted from natural systems.

Total "Net" Use Figures for All Extractions Other than Environment in DWR's Bulletin 160 Series								
	1957	1966	1970	Report Year		1987	1994	1998
Year Projected (actual figures in bold)				1974	1983			
1950	--	--	--	--	--	--	--	--
1960	--	23,106	--	--	--	--	--	--
1967	--	--	28,590	--	--	--	--	--
1972	--	--	--	--	--	--	--	--
1980	--	--	--	--	33,821	34,150	--	--
1985	--	--	--	--	--	34,220	--	--
1990	--	31,470	34,520	--	35,285	--	35,100	--
1995	--	--	--	--	--	--	--	--
2000	--	--	--	--	36,155	--	35,500	--
2010	--	--	--	--	37,330	35,620	36,100	--
2020	--	38,000	39,760	--	--	--	36,900	--

Sources of figures by report year:

- 1957 California Department of Water Resources, Bulletin 3, *The California Water Plan*, May 1957.
- 1966 California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March 1966, p. 53, Table 6.
- 1970 California Department of Water Resources, Bulletin 160-70, *Water for California*, December 1970, p.47, Table 4.
- 1974 California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974, The 1974 report provided four scenarios. Figures above are the suggested scenario for the given year as stated in the report (p.4).
- 1983 California Department of Water Resources, Bulletin 160-83, *The California Water Plan*, December 1983, pp. 169-170, Tables 50-53.
- 1987 California Department of Water Resources, Bulletin 160-87, *California Water: Looking to the Future*, November 1987, p.16.
- 1994 California Department of Water Resources, Bulletin 160-93, *California Water Plan Update*, October, 1994, Executive Summary, p.25. Figures reflect "average" net demand in each year and are based on urban, agricultural, and other. "Environmental water" is deducted for comparison purposes.
- 1998 California Department of Water Resources, Bulletin 160-98, *The California Water Plan Update*, November, 1998.

Total "Applied" Use Figures for All Extractions Other than Environment

Two trends are worth noting with regard to the "applied" water figures below. The first is that total "applied" water has more than doubled since the 1950s (bold figures). The second is the steady decline, until 1998, in the forecasted figures (bottom line).

Total "Applied" Use Figures for All Extractions Other than Environment in DWR's Bulletin 160 Series								
	<i>Report Year</i>							
	1957	1966	1970	1974	1983	1987	1994	1998
<i>Year Projected</i> (actual figures in bold)								
1950	21,033	--	--	--	--	--	--	--
1960	--	31,739	--	--	--	--	--	--
1967	--	--	36,020	--	--	--	--	--
1972	--	--	--	37,400	--	--	--	--
1980	--	--	--	--	42,199	42,840	--	--
1985	--	--	--	--	--	40,460	--	--
1990	--	40,800	42,200	44,400	43,330	--	39,200	--
1995	--	--	--	--	--	--	--	42,550 *
2000	--	--	--	--	43,695	--	40,200	--
2010	--	--	--	--	44,705	43,270	41,100	--
2020	51,128	49,705	47,980	47,000	--	--	42,300	43,520

* The 1998 figure reflects DWR's changed methodology.

Sources of figures by report year:

1957	California Department of Water Resources, Bulletin 3, <i>The California Water Plan</i> , May 1957, p.14, Table 3.
1966	California Department of Water Resources, Bulletin 160-66, <i>Implementation of the California Water Plan</i> , March 1966, p. 53, Table 6.
1970	California Department of Water Resources, Bulletin 160-70, <i>Water for California</i> , December 1970, p.47, Table 4.
1974	California Department of Water Resources, Bulletin 160-74, <i>The California Water Plan</i> , November 1974, p.89, Table 16. The 1974 report provided four scenarios. Figures above are the suggested scenario for the given year as stated in the report (p.4).
1983	California Department of Water Resources, Bulletin 160-83, <i>The California Water Plan</i> , December 1983, pp. 169-170, Tables 50-53.
1987	California Department of Water Resources, Bulletin 160-87, <i>California Water: Looking to the Future</i> , November 1987, p.16.
1994	California Department of Water Resources, Bulletin 160-93, <i>California Water Plan Update</i> , October, 1994, Executive Summary, p.25. Figures reflect "average" net demand in each year and are based on urban, agricultural, and other. "Environmental water" is deducted for comparison purposes.
1998	California Department of Water Resources, Bulletin 160-98, <i>The California Water Plan Update</i> , November, 1998, Vol.1, p.4-52, Table 4-26.

Urban “Demand” Projections, “Net Water”

“Net” urban water use increased rapidly from the 1950s through the 1980s. DWR, using the Department of Finance’s (DOF) population projections, forecasts significant increases in urban water use. Unfortunately, DWR eliminated the “net” water use analysis in the most recent plan.

Urban “Demand” Projections “Net Water” in DWR’s Bulletin 160 Series								
<i>Year Projected</i> (actual figures in bold)	<i>Report Year</i>							
	1957	1966	1970	1974	1983	1987	1994	1998
1950	--	--	--	--	--	--	--	--
1960	--	--	--	--	--	--	--	--
1967	--	--	3,730	--	--	--	--	--
1972	--	--	--	--	--	--	--	--
1980	--	--	--	--	4,978	4,980	--	--
1985	--	--	--	--	--	5,590	--	--
1990	--	--	6,400	--	5,670	--	6,800	--
1995	--	--	--	--	--	--	--	--
2000	--	--	--	--	6,205	--	7,900	--
2010	--	--	--	--	6,840	7,190	9,200	--
2020	--	--	10,300	--	--	--	10,500	--

Sources of figures by report year:

- 1957 California Department of Water Resources, Bulletin 3, *The California Water Plan*, May 1957.
- 1966 California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March 1966, (The report does not identify "net" water demand by category.)
- 1970 California Department of Water Resources, Bulletin 160-70, *Water for California*, December 1970, p.47, Table 4.
- 1974 California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974. (The report does not state net figures.)
- 1983 California Department of Water Resources, Bulletin 160-83, *The California Water Plan*, December 1983, pp. 169-170, Tables 50-53.
- 1987 California Department of Water Resources, Bulletin 160-87, *California Water: Looking to the Future*, November, 1987, p.16.
- 1994 California Department of Water Resources, Bulletin 160-93, *California Water Plan Update*, October, 1994, Executive Summary, p.25. Figures reflect "average" net demand in each year.
- 1998 California Department of Water Resources, Bulletin 160-98, *The California Water Plan Update*, November, 1998, does not identify “net” water demand.

Urban “Demand” Projections, “Applied Water”

“Applied” urban water use doubled in the ten years between 1957 and 1966 according to DWR figures. Between 1957 and 1998, the “applied” figure increased by over five times. DWR forecasts increased urban use even with efficiency improvements under the urban BMP program due to population increases projected by DOF. As discussed in further detail, this forecast does not adequately account for economic and technical factors that may significantly reduce urban “applied” and “net” water use.

Urban “Demand” Projections “Applied Water” in DWR’s Bulletin 160 Series								
	<i>Report Year</i>							
	1957	1966	1970	1974	1983	1987	1994	1998
<i>Year Projected</i> (actual figures in bold)								
1950	1,656	--	--	--	--	--	--	--
1960	--	3,257	--	--	--	--	--	--
1967	--	--	4,380	--	--	--	--	--
1972	--	--	--	5,040	--	--	--	--
1980	--	--	--	--	5,762	5,860	--	--
1985	--	--	--	--	--	6,590	--	--
1990	--	8,480	7,370	6,400	6,600	--	7,800	--
1995	--	--	--	--	--	--	--	8,770
2000	--	--	--	--	7,265	--	9,300	--
2010	--	--	--	--	8,070	8,710	10,900	--
2020	8,301	14,000	11,840	9,730	--	--	12,700	12,020

Sources of figures by report year:

- 1957 California Department of Water Resources, Bulletin 3, *The California Water Plan*, May 1957, p.14, Table 3.
- 1966 California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March 1966, p.53, Table 6.
- 1970 California Department of Water Resources, Bulletin 160-70, *Water for California*, December 1970, p.47, Table 4.
- 1974 California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974, p.89, Table 16. (The figures are "applied" rather than net. The report does not state net figures. Scenarios II for 1990 and III for 2020 are based on DWR statement on p.4.)
- 1983 California Department of Water Resources, Bulletin 160-83, *The California Water Plan*, December 1983, p. 169-170, Tables 50-53.
- 1987 California Department of Water Resources, Bulletin 160-87, *California Water: Looking to the Future*, November 1987, p.16.
- 1994 California Department of Water Resources, Bulletin 160-93, *California Water Plan Update*, October 1994, Executive Summary, p.25. Figures reflect "average" net demand in each year.
- 1998 California Department of Water Resources, Bulletin 160-98, *The California Water Plan Update*, November, 1998, Vol. 1, p.4-52, Table 4-26.

Agriculture "Demand" Projections, "Net Water"

Inconsistencies in methodology and data presentation make comparison of "net" water use in the agricultural sector difficult. Agricultural water use appears to have peaked in the 1980s, with a decline evident since.

Agriculture "Demand" Projections "Net Water" in DWR's Bulletin 160 Series								
<i>Year Projected</i> (actual figures in bold)	<i>Report Year</i>							
	1957	1966	1970	1974	1983	1987	1994	1998
1950	--	--	--	--	--	--	--	--
1960	--	--	--	--	--	--	--	--
1967	--	--	24,430	--	--	--	--	--
1972	--	--	--	--	--	--	--	--
1980	--	--	--	--	27,045	27,340	--	--
1985	--	--	--	--	--	26,950	--	--
1990	--	--	27,460	--	27,865	--	26,800	--
1995	--	--	--	--	--	--	--	--
2000	--	--	--	--	28,215	--	26,100	--
2010	--	--	--	--	28,725	26,750	25,400	--
2020	--	--	28,660	--	--	--	--	--

Sources of figures by report year:

- 1957 California Department of Water Resources, Bulletin 3, *The California Water Plan*, May 1957.
- 1966 California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March 1966, (The report does not identify "net" water demand by category.)
- 1970 California Department of Water Resources, Bulletin 160-70, *Water for California*, December 1970, p.47, Table 4.
- 1974 California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974, The report does not state net figures.
- 1983 California Department of Water Resources, Bulletin 160-83, *The California Water Plan*, December 1983, p. 169-170, Tables 50-52.
- 1987 California Department of Water Resources, Bulletin 160-87, *California Water: Looking to the Future*, November, 1987, p.16.
- 1994 California Department of Water Resources, Bulletin 160-93, *California Water Plan Update*, October, 1994, Executive Summary, p.25. Figures reflect "average" net demand in each year.
- 1998 California Department of Water Resources, Bulletin 160-98, *The California Water Plan Update*, November, 1998, does not identify "net" water use.

Agriculture “Demand” Projections, “Applied Water”

“Applied” water use in the agricultural sector peaked in the mid-1980s and has declined since. The 1998 figure is misleading in that it reflects a changed methodology which incorporates conveyance losses not counted in previous years.⁵⁶

Agriculture “Demand” Projections “Applied Water” in DWR’s Bulletin 160 Series								
	<i>Report Year</i>							
	1957	1966	1970	1974	1983	1987	1994	1998
<i>Year Projected</i> (actual figures in bold)								
1950	19,044	--	--	--	--	--	--	--
1960	--	28,482	--	--	--	--	--	--
1967	--	--	31,170	--	--	--	--	--
1972	--	--	--	31,700	--	--	--	--
1980	--	--	--	--	35,636	36,120	--	--
1985	--	--	--	--	--	32,910	--	--
1990	--	32,320	34,080	36,400	35,820	--	31,100	
1995	--	--	--	--	--	--		33,780
2000	--	--	--	--	35,470	--	30,200	--
2010	--	--	--	--	35,650	33,490	29,400	--
2020	41,106	35,705	35,210	36,100	--	--	28,800	31,500

Sources of figures by report year:

- 1957 California Department of Water Resources, Bulletin 3, *The California Water Plan*, May 1957, p.14, Table 3.
- 1966 California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March 1966, p.53, Table 6.
- 1970 California Department of Water Resources, Bulletin 160-70, *Water for California*, December 1970, p.47, Table 4.
- 1974 California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974, p.89, Table 16. (Scenario II for 1990 and scenario III for 2020 are based on DWR statement on page 4.)
- 1983 California Department of Water Resources, Bulletin 160-83, *The California Water Plan*, December 1983, p. 169-170, Tables 50-53.
- 1987 California Department of Water Resources, Bulletin 160-87, *California Water: Looking to the Future*, November, 1987, p.16.
- 1994 California Department of Water Resources, Bulletin 160-93, *California Water Plan Update*, October, 1994, Executive Summary, p.25. Figures reflect "average" net demand in each year.
- 1998 California Department of Water Resources, Bulletin 160-98, *The California Water Plan Update*, November, 1998, Vol. 1, pp.4-52, Table 4-26.

Environment "Demand" Projections, "Net"

The environment does not "demand" water. Demand is a function of price in a market system. The water accounted for in DWR's "net" and "applied" categories for the environment reflect a widely varied methodology which is of very little use for analysis.

Environment "Demand" Projections "Net Water" in DWR's Bulletin 160 Series								
	<i>Report Year</i>							
	1957	1966	1970	1974	1983	1987	1994	1998
<i>Year Projected</i> (actual figures in bold)								
1955	--	--	--	--	--	--	--	--
1960	--	--	--	--	--	--	--	--
1967	--	--	435	--	--	--	--	--
1972	--	--	--	--	--	--	--	--
1980	--	--	--	--	646	1,830	--	--
1985	--	--	--	--	--	1,680	--	--
1990	--	--	650	--	705	--	28,400	--
1995	--	--	--	--	--	--	--	--
2000	--	--	--	--	710	--	28,800	--
2010	--	--	--	--	720	1,680	28,800	--
2020	--	--	800	--	--	--	28,800	--

Sources of figures by report year:

- 1957 California Department of Water Resources, Bulletin 3, *The California Water Plan*, May 1957.
- 1966 California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March 1966, (The report does not identify "net" water demand by category.)
- 1970 California Department of Water Resources, Bulletin 160-70, *Water for California*, December 1970, p.47, Table 4.
- 1974 California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974, The report does not state net figures.
- 1983 California Department of Water Resources, Bulletin 160-83, *The California Water Plan*, December 1983, pp.169-170, Tables 50-53.
- 1987 California Department of Water Resources, Bulletin 160-87, *California Water: Looking to the Future*, November 1987, p. 16, provides figures only for aggregated "other" water uses including environmental needs.
- 1994 California Department of Water Resources, Bulletin 160-93, *California Water Plan Update*, October, 1994, Executive Summary, p.25. Figures reflect "average" net demand in each year.
- 1998 California Department of Water Resources, Bulletin 160-98, *The California Water Plan Update*, November, 1998.

Environment “Demand” Projections, “Applied”

Changes in methodology of accounting for water make comparison the “environment” data virtually useless. *Bulletin 160-93* and *Bulletin 160-98* have shifted from ignoring water in natural systems to questionable accounting approaches that seem to include various flows.

Environment “Demand” Projections “Applied Water” in DWR’s Bulletin 160 Series								
	<i>Report Year</i>							
	1957	1966	1970	1974	1983	1987	1994	1998
<i>Year Projected</i> (actual figures in bold)								
1950	333	--	--	--	--	--	--	--
1960	--	--	--	--	--	--	--	--
1967	--	--	475	--	--	--	--	--
1972	--	--	--	655	--	--	--	--
1980	--	--	--	--	743	860	--	--
1985	--	--	--	--	--	960	--	--
1990	--	--	745	806	795	--	28,800	--
1995	--	--	--	--	--	--	--	36,940
2000	--	--	--	--	800	--	29,300	--
2010	--	--	--	--	810	1,020	29,300	--
2020	1,721	--	925	846	--	--	29,300	36,980

Sources of figures by report year:

- 1957 California Department of Water Resources, Bulletin 3, *The California Water Plan*, May 1957, p.14, Table 3, (based on “miscellaneous” category).
- 1966 California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March 1966, (The report does not identify water demand by categories other than “urban” and “agriculture”).
- 1970 California Department of Water Resources, Bulletin 160-70, *Water for California*, December 1970, p.47, Table 4.
- 1974 California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974, p.89, Table 16.
- 1983 California Department of Water Resources, Bulletin 160-83, *The California Water Plan*, December 1983, pp.169-170, Tables 50-53.
- 1987 California Department of Water Resources, Bulletin 160-87, *California Water: Looking to the Future*, November 1987, p.16, provides figures only for aggregated “other” water uses including environmental.
- 1994 California Department of Water Resources, Bulletin 160-93, *California Water Plan Update*, October, 1994, Executive Summary, p.25. Figures reflect “average” net demand in each year.
- 1998 California Department of Water Resources, Bulletin 160-98, *The California Water Plan Update*, November, 1998, Vol. 1, p.4-52, Table 4-26.

Comparison of Total Water “Demand” Forecasts

The following summary provides important insights into the changing assumptions and actual water use trends in the second half of the 20th century.

Comparison of Total Water “Demand” Forecasts in DWR’s Bulletin 160 Series								
<i>DWR Bulletin</i>	<i>3</i>	<i>160-66</i>	<i>160-70</i>	<i>160-74</i>	<i>160-83</i>	<i>160-87</i>	<i>160-93</i>	<i>160-98</i>
Year Published	1957	1966	1970	1974	1983	1987	1994	1998
Base Year	1950	1960	1967	1972	1980	1985	1990	1995
Projections Made to Yr.	ultimate	2020	2020	2020	2010	2010	2020	2020
Projection Period (Yrs.)	ultimate	60	53	48	30	25	30	25
Base Yr. Demand* (Applied)	21,033	31,740	36,020	37,400	42,199	40,460	39,200	42,550
Projected Demand* (Applied)**	51,128	49,700	47,980	47,000	44,705	43,220	41,800	43,520
Increase From Base Year (Applied)*	30,095	17,960	11,960	9,600	2,506	2,760	2,600	970
% Increase From Base Yr. to Final Projected Yr. (Applied)	58%	36%	25%	20%	6%	7%	6%	2%
Base Year Demand* (Net)	--	--	28,590	--	33,821	34,220	35,100	--
Projected Demand* (Net)**	--	--	39,760	--	37,330	35,620	36,900	--
% Increase From Base Year to Final Projected Year (Net)	--	--	25%	-	9%	4%	5%	--
Total Increase From Base Year (Net)*	--	--	11,170	-	3,509	1,400	1,800	--
Irrigated Acreage in Final Projected Yr. (million acres)	19.98	10.78	10.24	9.85	10.95	9.5	9.32	8.6
* (1,000 acre feet)								
** (projections to 2010 or 2020 respectively)								

Sources of figures by report year:

1957	California Department of Water Resources, Bulletin 3, <i>The California Water Plan</i> , May 1957.
1966	California Department of Water Resources, Bulletin 160-66, <i>Implementation of the California Water Plan</i> , March 1966.
1970	California Department of Water Resources, Bulletin 160-70, <i>Water for California</i> , December 1970.
1974	California Department of Water Resources, Bulletin 160-74, <i>The California Water Plan</i> , November 1974.
1983	California Department of Water Resources, Bulletin 160-83, <i>The California Water Plan</i> , December 1983.
1987	California Department of Water Resources, Bulletin 160-87, <i>California Water: Looking to the Future</i> , November 1987.
1994	California Department of Water Resources, Bulletin 160-93, <i>California Water Plan Update</i> , October 1994, (Applied figures for “other” are less than net and “depletion” in the methodology and terminology for this Bulletin.)
1998	California Department of Water Resources, Bulletin 160-98, <i>The California Water Plan Update</i> , November, 1998. (The anomaly of increases for both present and projected use is the result of a methodological change in accounting.)

Methodology and Scenarios

DWR has employed a variety of inconsistent approaches and methodologies in the California water plan series. One drawback to the ever-changing methodology is that comparison of the plans and data over time is complicated and in some cases impossible. Numerous problems with changing methodology are discussed below.

Methodology of the Bulletin 160 Reports

Year	Scenario Approach
1957	Single scenario of ultimate requirements
1966	Single demand and supply scenario
1970	Single demand and supply scenario
1974	Four demand scenarios and a single supply
1983	Single demand and supply scenario
1987	Single demand and supply scenario
1994	Single demand scenario and two supply scenarios (average and dry year)
1998	Average and Drought Year scenarios

Sources by report year:

1957	California Department of Water Resources, Bulletin 3, <i>The California Water Plan</i> , May 1957.
1966	California Department of Water Resources, Bulletin 16-66, <i>California Water Plan</i> , March 1966.
1970	California Department of Water Resources, Bulletin 16-70, <i>Water for California</i> , December 1970.
1974	California Department of Water Resources, Bulletin 16-74, <i>The California Water Plan</i> , November 1974.
1983	California Department of Water Resources, Bulletin 16-83, <i>The California Water Plan</i> , December 1983.
1987	California Department of Water Resources, Bulletin 16-87, <i>California Water Plan Update to the Future</i> , November 1987.
1994	California Department of Water Resources, Bulletin 16-94, <i>California Water Plan Update</i> , October 1994.
1998	California Department of Water Resources, Bulletin 16-98, <i>The California Water Plan Update</i> , November 1998.

Comparison of Projected "Net" Water "Demand" for Final Projected Year

Comparison of Projected "Net" Water "Demand" for Final Projected Year By Use Category in DWR's Bulletin 160 Series (in 1,000 AF)

(Report Date) (Final Projected Year)	1957 "Ultimate"	1966 2020	1970 2020	1974 2020	1983 2010	1987 2010	1994 2020	1998 2020
Agriculture	--	--	28,660	--	28,725	26,750	24,900	--
Urban	--	--	10,300	--	6,840	7,190	10,500	--
Urban/Ag. Combined	--	38,000	38,960	--	35,565	33,940	35,400	--
Power Plant Cooling	--	--	--	--	--	--	--	--
Energy Production	--	--	--	--	175	--	--	--
Conveyance Losses	--	--	--	--	870	--	--	--
Other*	--	--	--	--	--	1,680	1,500	--
Fish, Wildlife, & Recreation	--	--	800	--	720	--	--	--
Total		38,000	39,760	--	37,330	35,620	36,900	--
"Environmental Water" **		--	--	--	--	--	28,800	--

* (Includes major conveyance facility losses, recreation uses, and energy production.)

** (New category including water previously allocated to the environment.)

Sources of figures by report year:

- 1957 California Department of Water Resources, Bulletin 3, *The California Water Plan*, May 1957.
- 1966 California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March 1966, p. 53, Table 6. (The 1966 report did not desegregate "net" water for Urban and Agriculture.)
- 1970 California Department of Water Resources, Bulletin 160-70, *Water for California*, December 1970, p.47, Table 4.
- 1974 California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974, based on conclusion of DWR that scenario III is the appropriate basis for projections to 2020, p.4. Net water demand is not identified for Urban and Agriculture.
- 1983 California Department of Water Resources, Bulletin 160-83, *The California Water Plan*, December 1983, p.170, Table 53. (Wildlife and recreation figures are combined.)
- 1987 California Department of Water Resources, Bulletin 160-87, *California Water: Looking to the Future*, November, 1987, p.16.
- 1994 California Department of Water Resources, Bulletin 160-93, *California Water Plan Update*, October, 1994, Executive Summary. Figures reflect "average" demand in each year.
- 1998 California Department of Water Resources, Bulletin 160-98, *The California Water Plan Update*, November, 1998. (Bulletin 160-98 dropped the "net" water use analysis.

Terms and Categories of "Demand"

Comparison of Projected "Applied" Water "Demand" for Final Projected Year by Use Category in DWR's Bulletin 160 Series (1,000 AF)

(Report Date) (Final Projected Year)	1957 "Ultimate"	1966 2020	1970 2020	1974 2020	1983 2010	1987 2010	1994 2020	1998 2020
Agriculture	41,106	35,705	35,210	36,100	35,650	33,490	28,800	31,500
Urban	8,301	14,000	11,840	9,730	8,070	8,710	12,700	12,020
Urban/Ag. Combined	49,407	49,705	47,050	45,830	43,720	42,200	41,500	43,520
Power Plant Cooling	--	--	--	350	--	--	--	--
Energy Production	--	--	--	--	175	--	--	--
Conveyance Losses	--	--	--	--	--	--	--	--
Miscellaneous	1,721	--	--	--	--	--	--	--
Other*	--	--	--	--	--	1,020	300	--
Fish, Wildlife, & Recreation	--	--	925	846	810	--	--	--
Total	51,128	49,705	47,975	47,026	44,705	43,220	41,800	43,520
"Environmental Water"***		--	--	--	--	--	29,300	36,940

* (Includes major conveyance facility losses, recreation uses, and energy production.)

** (New category including water previously allocated to the environment.)

Sources of figures by report year:

- 1957 California Department of Water Resources, Bulletin 3, *The California Water Plan*, May 1957.
- 1966 California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March 1966, p. 53, Table 6. (The 1966 report did not desegregate "net" water for Urban and Agriculture.)
- 1970 California Department of Water Resources, Bulletin 160-70, *Water for California*, December 1970, p.47, Table 4.
- 1974 California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974, based on conclusion of DWR that scenario III is the appropriate basis for projections to 2020, p.4, and data on p. 89, Table 16.
- 1983 California Department of Water Resources, Bulletin 160-83, *The California Water Plan*, December 1983, p.170, Table 53. (Wildlife and recreation figures are combined.)
- 1987 California Department of Water Resources, Bulletin 160-87, *California Water: Looking to the Future*, November, 1987, p.16.
- 1994 California Department of Water Resources, Bulletin 160-93, *California Water Plan Update*, October, 1994, Executive Summary, p.25. Figures reflect "average" demand in each year.
- 1998 California Department of Water Resources, Bulletin 160-98, *The California Water Plan Update*, November, 1998, p.4-52, Table 4-26.

Terms and Categories of "Demand"

California Population Projections in DWR's Bulletin 160 Series (in millions)

	<i>Report Year</i>							
	1957	1966	1970	1974	1983	1987	1994	1998
<i>Year Projected</i> (actual figures in bold)								
1955	13	--	--	--	--	--	--	--
1960	--	15.7	--	--	--	--	--	--
1967	--	--	19.1	--	--	--	--	--
1972	--	--	--	20.5	--	--	--	--
1980	--	--	--	--	23.8	23.7	--	--
1985	--	--	--	--	--	26.1	--	--
1990	--	35.3	29	26.7	27.9	--	30	--
1995	--	--	--	--	--	--	--	32.1
2000	--	--	--	--	31.3	--	36.5	--
2010	--	--	--	--	34.4	36.3	42.5	--
2020	--	54.3	44.7	36.6	--	--	48.9	47.5

Sources of figures by report year:

- 1957 California Department of Water Resources, Bulletin 3, *The California Water Plan*, May 1957, p.v.
- 1966 California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March 1966, p.43, Table 4.
- 1970 California Department of Water Resources, Bulletin 160-70, *Water for California*, December, 1970, p.34, Table 1.
- 1974 California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974, p.67, based on scenario II and III per comment on p.4.
- 1983 California Department of Water Resources, Bulletin 160-83, *The California Water Plan*, December 1983, p.153.
- 1987 California Department of Water Resources, Bulletin 160-87, *California Water: Looking to the Future*, November 1987, p.6
- 1994 California Department of Water Resources, Bulletin 160-93, *California Water Plan Update*, October, 1994, Vol.1, p.142, Table 6-1.
- 1998 California Department of Water Resources, Bulletin 160-98, *The California Water Plan Update*, November, 1998, p. ES4-2, Table ES4-1.

ASSESSMENT OF THE STATE WATER PLANNING PROCESS

Water resource management in California is at a critical juncture as evolving policies and physical limits of the State's water supply infrastructure collide.

California Water Plan Update, Bulletin 160-93 ⁵⁷

The Department of Water Resources, the Resources Agency, and the state governance structure in general, is confused as to the purpose, role, and function of the State Water Plan. The plan, and the process used to develop it, are seriously flawed. California *is* at a critical juncture, as DWR noted in *Bulletin 160-93* in the quote above. The critical policy question is whether there is a formal policy recognition that it is the *resource* that is limited, or the continuation of the “gap” logic that perpetually seeks to expand *infrastructure* to extract a supposedly limitless resource to meet a limitless “demand” for water. The State Water Plan, and the vision of DWR, has been focused on the latter.

The *purpose*, *function*, and *goal* of the plan should be re-examined, and the *process* by which state water planning takes place should be changed to meet current and projected policy needs. DWR noted on page 1 of *Bulletin 160-93* the “need for a comprehensive water policy to guide California’s water management and planning.”⁵⁸ They were correct, although the notion the department had with regard to “policy” was, and remains, flawed.

Clarification of the Purpose and Goal of the State Water *Plan* and its Relation to the State Water *Project*

The purpose and role of the State Water Plan has changed over time. In the early days, the goal and purpose seemed clear. Harvey O. Banks was explicit in 1957. The document was a “master plan” for the full development and use of all of the state’s water. As noted above, he wrote in his letter of transmittal regarding the first California water plan: ⁵⁹

Bulletin No. 3 presents a master plan to guide and coordinate the activities of all agencies in the *planning, construction, and operation* of works required for the control, development, protection, conservation, distribution, and utilization of California's water resources...

The full solution of California's water problems thus becomes *essentially a financial and engineering problem.*

To Banks, the document was *a development plan*, and the challenge of implementation was one of engineering solutions and securing government support and financing. The goal was to *conserve* (i.e. divert and extract) all of the state's water and put it to use.

The third state water plan, *Bulletin 160-70*, acknowledged that the role of DWR in state water planning, and in building and operating the state *project*, were unclear, at least in the public's perception.

Considerable confusion has been evident concerning the California Water Plan and its relationship to the State Water Project. It is important that the distinction between the two be explained at the outset to facilitate understanding of the information presented in this bulletin.⁶⁰

Bulletin 160-70 goes on to explain the difference between the planning process and the state role as a supply developer and purveyor. The more fundamental issue, however, of one agency determining and declaring the "needs" and of the state and at the same time seeking public support to provide for those "needs" is not addressed. Indeed, the issue is not even acknowledged. Instead, DWR explains in 1970 that its *nearly completed* system will meet the "needs" of the state, at least in part, as identified in its plan.

The State Water Project, currently nearing completion by the Department of Water Resources, is a specific system of physical facilities which will satisfy water demands in large areas of the State in the immediate future.⁶¹

More than 50 years after the state legislature requested the State-Wide Water Resources Investigation, and more than 40 years after the first water plan in 1957, there is a pressing

need for clarification of the goal of the state plan. The most recent plan contains several statements regarding its purpose and goal:

The Bulletin 160 series assesses California's agricultural, environmental, and urban water needs and evaluates water supplies, *in order to quantify the gap between future water demands and the corresponding water supplies.*⁶²

This statement is both problematic and misleading. *Bulletin 160-98* goes much further than “quantifying a gap” between “demand” and supply. It argues for new facilities and seeks a broader role for the department in planning new supply projects. In short, DWR seeks a role more similar to the one Harvey Banks articulated than the one it is playing. It was not politically realistic in 1998 to do that, however, so DWR couches its aspirations and engineering approach in considerable subterfuge.

Elsewhere in *Bulletin 160-98*, the stated “purpose” is limited to a projection of needs based on present conditions:

The purpose of Bulletin 160-98 is to predict future water needs based on today's conditions.⁶³

Its goal is then reduced to an analysis of what water purveyors are “likely” to do:

...accurately reflecting actions that *water purveyors* statewide *would be reasonably likely to implement* by 2020.⁶⁴

From the ambitious ideas and goal of the 1950s: damming all the state's rivers and diverting all of the water by applying concrete engineering solutions to the challenge, to the “reflection” of the “reasonably likely” plans of local purveyors, is a major change.

The state needs, and deserves, a plan for its water resources that addresses the realities of a different time in history. Neither a comprehensive engineering solution nor a reflection of purveyors' plans serves the state's interests. The state water planning process is in need of fundamental reform. The following comments outline some of the issues that need attention.

The *Bulletin 160* Planning Process in Need of Reform

The Resources Agency and DWR presented the latest draft *Bulletin 160* to the press and the public in January 1998. The Associated Press dutifully relayed the message that the agency was seeking to communicate in precisely the terms it was hoping for. Under the headline '*Serious*' *water need predicted by 2020*, the AP opened with a quote from the state claiming the specter of "a serious statewide shortage early in the next century." The AP then explains: "The two-volume, 806-page report lists hundreds of projects which could be built to help alleviate the projected shortage."⁶⁵ The "state plan" is in fact a strongly biased exercise in perpetually building a case for building more supply projects. The state plans have never been objective analyses of the state's cost-effective uses of limited water supplies. Instead, they have been boosters for "infrastructure" development. With agricultural water use declining since the 1980s (the pervious rational for ever escalating "demand"), *Bulletin 160-98* argues that population growth projections require new infrastructure (without analyzing the cost/benefit of that infrastructure against other options). In Chapter Two of the Executive Summary, DWR opens with the following statement:

A common theme in previous California Water Plan updates has been the need to respond to the State's continually increasing population. Population growth brings with it the need for new or expanded infrastructure.⁶⁶

California's history has in fact been as much characterized by supply development *in search* of a customer as the reverse. Boosterism, and growth as the water development mantra (along with government support) played a major role in expanding both population and water use in California. The current version is to claim the necessity of "new" water supply development based on population growth projections and on *current use and price* patterns.

Bulletin 160-98 concludes with a revealing pitch for an increased role in planning for yet more supply-side water projects.

An appropriate State role would be for the Department to take the lead in performing feasibility studies of *potential storage projects* – not on behalf of the SWP, but on behalf of all potentially interested water agencies. *State funding support is needed* to identify likely projects, so that local agencies may determine how those projects *might* benefit their service areas. In concept, the Department could use State funding to complete project feasibility studies, permitting, and environmental documentation for likely new storage facilities...⁶⁷

DWR's stated interest in a changed mission is important. The "appropriate" state role for DWR has been a subject of discussion in water policy circles since its inception, and many feel it should move in precisely the opposite direction. Every state plan has identified a shortage and then provided plans to build facilities to deal with it.

At present, DWR is *in theory* the neutral and objective gatherer of facts on state water use and supplies, the disinterested operator of the SWP, and the objective planning entity responsible for California's long-range analysis and planning. Its track record indicates that there are in fact serious conflicts between these institutional roles. The comment quoted above clarifies the actual intent of the department.

There is a critical need for objective, accurate information on California's water resource base, its uses and limits, and the full cost-effectiveness and cost/benefit of alternative uses. *Bulletin 160-98* is a testimony to the need for reform in California water policy. It exhibits deep-rooted biases that ignore market signals while embracing a past era of dam building as the answer to all water management challenges. The report embraces "new storage facilities" and "supply augmentation" approaches despite "perceived implementability constraints" and "affordability" issues.⁶⁸ Rather than recognize the cost-ineffectiveness and unacceptable environmental impacts of its vision, the department calls for an expanded state role in new storage facilities.

The Shifting Methodology for *Bulletin 160*

The utility of the California water plans is seriously compromised due to inconsistent methodologies employed by DWR. While there is always a need to update information and improve tools and procedures, the Bulletin 160 series suffers from inconsistencies that reveal a serious institutional bias. In the interest of providing policy-relevant information for decision-makers, water managers, water users, and the public, the state should review the state water plan process and develop a set of guidelines. The following comments are intended as a starting point for consideration.

Quantifying California's Water Resources

Contradictory and inaccurate figures regarding the total water resources in California have been presented in the State Water Plans since the first one was published in 1957. The California Water Plan series, beginning with *Bulletin No.3*, has been based on a calculated average annual water supply for California of a little over 76 MAF. *Bulletin No.3* states a figure of 76,362,000 acre feet per year in one place⁶⁹ and provides a table in another with a total figure (incorrectly summed) of 76,212,000 acre feet per year.⁷⁰ These figures were in turn based on *Bulletin No.1, Water Resources of California*, published in 1951.⁷¹ The total water in the first figure includes 71 MAF of average annual runoff in the state, and 5.362 MAF of imported water from the Colorado River, based on "California's rights in and to the waters" in that amount.⁷² (California's entitlement to Colorado River water was clarified and set at 4.4 MAFY, plus a portion of "surplus" water when available, by the US Supreme Court in 1964.)

Total Water Supplies Available in California Average Annual Supply <i>Bulletin No.3</i> ⁷³	
Seasonal runoff	71,000,000
Colorado River	5,326,000
Total Supply	76,326,000

The second figure is set forth in a summary table (Table 1 in *Bulletin No.3*).⁷⁴ (To complicate matters further, an error in basic arithmetic for a sum of the figures in the table *actually total 76,206,000, not the 76,212,000 figure indicated.* The table, as presented in *Bulletin No.3*, (with the original footnotes (a) and (b) and the incorrect total) is as follows:

Estimated Mean Seasonal Full Natural Runoff of Hydrographic Areas	
Hydrographic Area	Runoff (a)
North Coastal	28,890,000
San Francisco Bay	1,245,000
Central Coastal	2,448,000
South Coastal	1,227,000
Colorado River (b)	1,212,000
Sacramento River Basin	22,390,000
San Joaquin – Tulare Lake Basin	11,246,000
Lahontan	3,177,000
Colorado Desert	221,000
Colorado River (b)	4,150,000
Total Supply	76,212,000
(a) Values represent runoff from mountain and foothill areas generally at the base of the foothills. Comparatively little control is possible below that point.	
(b) Regulated flows representing California's rights in and to the waters of the Colorado River.	

DWR calculated the 71 MAFY figure based on seasonal flows during a 53-year period from 1894-95 through 1946-47. The variability during that time frame was from a high of 135 MAF in 1937-38 to a low of 18.3 MAF in 1923-24.⁷⁵ The Colorado River water import figure at 5.362 MAFY exceeds the base entitlement of 4.4 MAFY that California is now planning for.⁷⁶

In its most recent state water plan, *Bulletin 160-98*, DWR seems to assume a similar figure for total runoff in the state. It estimates total average precipitation at 200 MAFY,

with evaporation and transpiration accounting for 65%, or 130 MAFY of this amount. That would leave 35% or 70 MAFY as runoff.⁷⁷ This is roughly consistent with the 71 MAFY figure from *Bulletin No. 3*.

The disposition of the 70 or 71 MAFY is difficult to determine from the state water plans, and there appear to be inconsistencies in both assumptions and data. The tables below are taken from the two most recent California Water Plans, both produced in the 1990s: *Bulletin 160-93* and *Bulletin 160-98* respectively. The data presented in the two boxes is presented in the Executive Summaries in each report's basic overview data. In both cases it is presented in pie graph format. The data has been converted to table form for comparative purposes.

Several things are worth noting regarding the representation of the data. The first is that the total water supply figure of 85 MAFY is indicated from 1960 through 1990. *Bulletin No. 3* indicated total California water supplies of a little over 79 MAFY in 1957, but DWR shows supplies of 85 MAFY for 1960 in *Bulletin 160-93*. In 1995, however, the total appears as 79.5 MAFY. There is no explanation provided for the change of 5.5 MAFY other than that groundwater overdraft is not counted in the "base year" figures. A comparison to Table ES3-1 on page ES3-5 indicates that the 77.9 MAFY accounted for, plus the 1.46 MAFY of groundwater overdraft (from page ES3-7), totals 79.36 MAFY, or roughly the 79.5 MAFY indicated. The forecast for 25 years ahead indicates Colorado River supplies at 4.4 MAFY, and CVP and SWP supplies expanded. Again, adding in the groundwater overdraft forecast for 2020 (from page ES3-7), the total for 2020 is 79.15 MAFY. In the year 2020, the total pie in *Bulletin 160-98* has *increased* by 1.0 MAFY, though by then California is presumed to have *reduced* its use of Colorado River water to the 4.4 MAFY allocation. The explanation is presumably in DWR's assumptions, methodology, and calculation of reuse, return flows, and groundwater. A clear comparison of the differing assumptions and calculations would support greater utility of the water plan data and forecasts.

Bulletin 160-93 provides a breakdown of total water supplies for 1960 and 1990. *Bulletin 160-98* provides a “simplified” summary with three categories as follows. (Note the total water resources figures):

Comparison of Total Water “Disposition” Based on Average Annual Supply <i>Bulletin 160-93</i> ⁷⁸					
1960			1990		
Sector	MAFY	%	Sector	MAFY	%
Urban	2	2%	Urban	6	7%
Agriculture	20	24%	Agriculture	24	28%
Sub-Total	22	26%	Sub-Total	30	35%
Various Environmental and “Other” Flows					
Wetlands	1	1%	--		
Other Outflow	62	73%	Other Outflow	30	36%
--			Other	1	1%
--			Environmental	24	28%
--			Wetlands (1%)		
--			Delta Outflow (5%)		
--			Instream (1%)		
--			Wild and Scenic Rivers (21%)		
Sub-Total	63	74%	Sub-Total	55	65%
TOTAL	85	100%	TOTAL	85	100%

Comparison of Total Water “Use” Based on Average Annual Supply <i>Bulletin 160-98</i> ⁷⁹					
1995			2020		
Sector	MAFY	%	Sector	MAFY	%
Urban	8.8	11%	Urban	12.0	15%
Agriculture	33.8	43%	Agriculture	31.5	39%
Environmental	36.9	46%	Environmental	37.0	46%
TOTAL	79.5	100%	TOTAL	80.5	100%

“Net” vs. “Applied” Water Analysis

Bulletin 160-98 failed to provide “net” water use data consistent with previous bulletins. Rather than provide *both* “applied” and “net” figures for analysis *as in previous reports*, DWR dropped the “net” data claiming: “This change was made in response to public comments that net water data were more difficult to understand than applied water data.”⁸⁰ The result, as indicated in the tables, is data gaps that compromise analysis of temporal trends.

There appears to be no reason the report could not include both “net” and “applied” figures, as in past years. Indeed, it would be useful to have the historical analysis provided in the tables assembled above in each successive water plan as a basis for calibrating forecasts and to understand the work presented in previous plans. The trends are useful information, particularly for the long-range decisions under consideration

Calculation of Water “Use” Figures

The shifting methodology of determining “use” figures is a major problem. Comparisons between reports is difficult, if not impossible, because of these changes. The conclusions drawn by decision-makers and others will likely be mis-informed due to the shifting and mis-leading changes. For example, the base year figures and the forecasts in *Bulletin 160-98* employ a different method from previous years of calculating agricultural and urban use which differentially incorporates system losses. The total “applied” figures are therefore artificially high compared to what they would be as calculated in past years. The *Bulletin 160-98* figures indicate *increased* levels of use for agriculture, both in the base year and in the 2020 forecast, when in fact the volumes of water are forecast to *decrease* when calculated without the added loss factor. The appropriate method would be to indicate the loss factor for all years as a component of total use.

Environmental Water Estimates

Another important example of methodological changes that are misleading and inaccurate is the representation of environmental water “demand” and uses. *Bulletin 160-93* created a major new category of “environmental” water by counting instream flows and other water in the environment as “managed” water. *Bulletin 160-98* then added ten new waterways to this category⁸¹ and included certain flows on agricultural lands.⁸² While developing an improved understanding of water flows in natural systems is important for water planning, the methodology and logic employed by DWR is inconsistent and flawed. DWR admits in *Bulletin 160-98* that:

Converting from net water use analyses performed in prior editions of Bulletin 160 to the applied water budgets used in Bulletin 160-98 created a challenge in properly accounting for multiple instream flows within a river basin. Bulletin 160-98 used a simplified approach in which only the largest downstream flow requirement was included in the water budgets. This simplified approach undercounts applied instream flow requirements on streams having multiple requirements. The Department is developing a new modeling approach for the next water plan update that will more accurately quantify applied instream flows.

The problem is more than a modeling challenge. The underlying logic of DWR’s approach to quantifying flows and attributing them to multiple uses and legal requirements needs to be subjected to open, public discussion and debate. The methods and the assumptions employed need to be transparent and open to public review. The implications and policy relevance of the information presented can then be more properly determined. For example, water flows in wild and scenic rivers which are then used downstream for urban and agricultural purposes would not necessarily affect existing down-stream users, as DWR notes.⁸³

Inconsistent Normalized Data

Inconsistent methodologies for “normalizing” data for both supply and “demand” figures present serious problems in data analysis. The “normalization” of data is particularly problematic in that assumptions and assertions regarding such critical factors as “project delivery capabilities” are used in place of historical data for the SWP and CVP without full explanation or sound reasoning.⁸⁴ For example, *Bulletin 160-98*, in “explaining” why it does *not* use historical data for the SWP and CVP normalized figures, makes the following statement:

A notable exception to the above procedure [use of actual historical data] is the development of normalized CVP and SWP project deliveries. Supplies from these projects are developed from operations studies rather than historical data.⁸⁵

This “notable exception” is significant. DWR has long claimed that it could deliver full entitlement volumes of water from the SWP if contractors requested it. Full contract volumes are about 4.2 MAFY. Actual deliveries have averaged about half that amount. DWR simply asserts a *capacity*, and a legal *ability*, to divert and deliver volumes of water that it has not been able to deliver in the past. It offers no explanation for the assertion that future extractions and deliveries could *increase* in the face of limits imposed by legal constraints.

DWR indicates that under SWRCB Order WR 95-6 regarding Bay-Delta standards, it has the “average project capability” to deliver greater volumes of water than its historical average would indicate.⁸⁶ This assertion is also questionable in light of both court rulings and legislation requiring increased flows in natural systems to restore ecosystem damage and populations of endangered species.

CVP and SWP Deliveries Increasing

The SWP and the CVP are drawing the vast majority of their supplies from the delta. For reasons that DWR does not fully explain, the SWP and CVP extractions and deliveries are forecast to *increase* to address both expanding “demand” and to resolve groundwater

overdraft problems south of the delta. With existing facilities, the CVP is forecast to *increase* deliveries in average years by 2020 by 343 TAFY, from 7,004 TAFY to 7,347 TAFY, and the SWP will *increase* its deliveries in average years by 2020 by 313 TAFY, from 3,126 TAFY to 3,439 TAFY.⁸⁷ At the same time, groundwater overdraft in the San Joaquin River hydrologic region is forecast to *decline* from 239 TAFY to 63 TAFY, and for the Tulare Lake region, from 820 TAFY to 670 TAFY.⁸⁸ This forecast is not reconciled with the fact that between the 1990 base year in *Bulletin 160-93* and the 1995 base year in *Bulletin 160-98*, “most of the statewide *increase* in overdraft occurred in the San Joaquin and Tulare Lake regions.”⁸⁹

DWR’s “Fundamental Assumptions” are Inappropriate for the State Water Plan

DWR’s “fundamental assumptions” for planning California’s water future virtually guarantee a flawed analysis. The present = the future formula, adjusted for “reasonably likely” changes *envisioned by water purveyors*, is an inappropriate, seriously biased, and flawed basis upon which to plan for a critical resource in a trillion dollar economy.

DWR makes the following statement regarding the basis for *Bulletin 160-98*:

To develop 2020-level conditions, the Department makes a *fundamental assumption* that today’s conditions – facilities, programs, water use patterns, and other factors – are the basis for predicting the future.⁹⁰

The report then states clearly that “California’s water future” is based not on a vision, but on “*today’s conditions* and on *options considered by California’s water purveyors*.”⁹¹ In its methodology, only the “vision” of those who extract, divert, and sell water are included in the state plan. Options considered by other interests are not included. DWR does take license, however, to include its own “vision” in numerous places throughout *Bulletin 160-98*. The vision includes “features” like Auburn Dam⁹² (which receives a special advertisement in *Bulletin 160-98*), conveyance facilities, and an expanded role for DWR in planning and developing new water extraction projects.⁹³ Pressing its case, DWR

“emphasizes” the “need” for projects such as Auburn Dam and an enlarged Millerton Lake (both included in its supply plans, and “summary of likely options”)⁹⁴ even though they acknowledge that “both projects have controversial aspects, and neither of them is inexpensive.”⁹⁵ In truth, both projects are *highly* controversial, and DWR is strongly inserting its own bias in the “state plan” in favor of their development. As if project development required only routine processing, DWR makes the following telling statement:

The potential future water management options summarized in this section [Balancing Supply and Demand] *are still being planned*. Their implementation is *subject to* completion of environmental documents, permit acquisition, and compliance with regulatory requirements such as the ESA.⁹⁶

In other words, other than getting *approval* for these “not inexpensive” and highly controversial projects, DWR feels they are “reasonably likely” and is basing California’s water plans on their implementation. The other problem DWR fails to mention is funding. Given the costs involved, there is serious question as to who is expected to pay for the facilities. DWR fails to address this issue, but it does not hesitate to raise the usual specter that delay based on environmental concerns will lead to “shortages”.

If water management options are delayed or rendered infeasible as a result of these processes, or if their costs are increased to the point that the options are no longer affordable for the local sponsors, statewide shortages will be correspondingly affected.⁹⁷

The policy logic is clear: Advocate for projects that are cost-ineffective based on the ever-present “gap” and the “shortage” specter, and note that consideration of environmental damage is fine, as long as does not slow down or prevent construction. The idea that these “not inexpensive” supply options may simply fail any reasonable cost-effectiveness test, given a realistic accounting of full costs and benefits, and of realistic markets for water at a price that would support that cost, seems to have escaped DWR’s analysis. That environmental costs and damages are *real factors* to be considered in the cost and policy calculus also seems to elude the department.

A state water plan for the next 25 years should clearly develop a broader basis for forecasting a set of “likely” possibilities that goes beyond DWR’s and other purveyors’ plans. Some “facilities” (dams) are already being removed, and others are likely to follow. Technology for water use is evolving rapidly, and the courts and congress are actively moving toward environmental restoration policies and full-cost market approaches that will strongly influence DWR’s forecasts. Water planners should clearly be authorized to plan a stronger and more robust foundation for policy than *today’s water use patterns* and the facilities and programs presently in place.

An Elastic Water “Budget” for California Water

California’s water “budget” as presented in *Bulletin 160-98* appears to be geared for shopping. Though DWR chooses *not* to analyze the price elasticity of demand, it embraces considerable tolerance for *budget elasticity*. The liberal stretching builds on the confusion of the notions of *use* with *demand*, and then proceeds as follows:

Bulletin 160-98 calculates existing water supply and demand, then balances forecasted demand against existing supply and future water management options.⁹⁸

It then labels this “balance” a “water budget” and proceeds with an enumeration of “future water management options” to balance the budget.⁹⁹ Notably absent from the analysis are market signals. Remarkably, the DWR declares that:

Even with a reduction in Colorado River supplies to California’s 4.4 maf basic apportionment, annual average statewide supply is projected to *increase* about 0.2 maf by 2020 without implementation of new water supply options. While the expected increase in average year water supplies is *due mainly to higher CVP and SWP deliveries* (in response to higher 2020-level demands), new water production will also result from groundwater and from recycling facilities currently under construction.¹⁰⁰

Higher SWP and CVP deliveries, and more groundwater pumping while simultaneously reducing overdraft? The “plan” lacks in details of practicality, if not possibility.

Groundwater Overdraft Accounting

About a third of California's water supplies are derived from groundwater sources. The representation of groundwater data, and in particular the accounting for overdraft, is important for state water policy. The methodology for accounting for overdraft was changed in *Bulletin 160-98* such that estimated overdraft is excluded from the base year figure.¹⁰¹ *Bulletin 160-98* estimates a statewide *increase* in groundwater overdraft of 160 TAFY for the 1995 base year over the previous base year of 1990 (used in *Bulletin 160-93*).¹⁰² Total statewide overdraft in the 1995 base year is estimated at 1,460 TAF.¹⁰³ Yet DWR states that overdraft will be *reduced* in the future. The only explanation offered for the projected reductions in overdraft is based on *increased* deliveries from the CVP and SWP drawing water from the delta.

Assumptions Regarding Shifts to Increased SWP and CVP Use

DWR expects "demand" to shift from groundwater in the Central Coast region to SWP water delivered though the coastal branch.¹⁰⁴ The economic rational for a switch from relatively inexpensive groundwater supplies to rather expensive SWP supplies is not provided. Similarly, the method and economic logic for Central Valley groundwater users to shift from pumping to CVP and SWP delta water supplies, and the means by which these two projects could *increase* extractions at a time when extractions are being *reduced*, is unclear. As DWR notes in *Bulletin 160-98*, "surface water supplies have been *reduced* in recent years by Delta export restrictions, CVPIA implementation, and ESA requirements."¹⁰⁵ The numbers do not appear to add up.

Estimation and Representation of Conveyance Losses

DWR changed its method of accounting for "conveyance losses" in *Bulletin 160-98*. The latest report includes (without identifying the figures) the losses in each of the sectors rather than identifying them separately. DWR states that the change was made to

“simplify information presentation” in the report.¹⁰⁶ The result is an apparent increase in both the agricultural use figures (the sector with the largest losses) and the urban figures. This change compromises the ability of decision-makers, water managers, and others to properly compare data, as DWR admits in the following comment:

Most conveyance losses are associated with agricultural water use. Combining the “other” category [including the conveyance loss figures] into the major water use categories most affected the agriculture water demand forecast. *When conveyance losses are factored out of the Bulletin 160-98 forecast, agricultural water use decreases between Bulletin 160-93 and Bulletin 160-98.*¹⁰⁷

Translated, this comment admits that the data is highly misleading. For consistency and for utility in evaluating and crafting policy, DWR should provide a clear delineation of all water *uses* and *losses*. An analysis of options to reduce system losses, with costs and benefits identified, would also be useful.

Categorization of Water “Use”

Remarkably, categories of *water use* have changed with every Bulletin since the first in 1957. Starting with “requirements” for “Irrigation, Urban/Suburban/Industrial, and Miscellaneous” in 1957, DWR shifted accounting and terms to “Agricultural, Urban, Fish/Wildlife/Recreation” in 1966, then to “demand” for “Agricultural, Urban, Power Plant Cooling” in 1970, then back to “Agricultural, Urban, Fish/Wildlife/Recreation” in 1974. In 1983 DWR added “energy” to “Agricultural, Urban, Wildlife/Recreation, Energy Production” and then “environment” in 1987 with “Agricultural, Urban, Environmental, Energy Production”. DWR added “other” in 1994 “Agricultural, Urban, Environmental, Other”. The most recent Bulletin, 1998, returned to “Agricultural, Urban, Environmental”, but in both 1993 and 1998, the term and accounting for “environmental” water is radically changed.

A useful analysis for DWR would be to go back and standardize its methods, from Bulletin 3 to the present, and clarify for decision-makers and water managers how these ever-shifting categories translate into a consistent accounting system.

Confusion of “Demand” with “Use” and “Need”

One of the most serious shortcomings of the DWR methodology is the consistent failure to distinguish between *demand* as a function of price, and the water *used* for various purposes at any price, for any purpose. The problem is compounded by the apparent failure to perceive the difference. For example, on the second page of the Executive Summary of the most recent *Bulletin 160*, a section entitled “Overview of California’s Water Needs” declares a *shortage*, which it defines as the difference between supplies and *demands*. The tables it references are all labeled water “*use*”. The difference between *use*, *demand*, and *need* does not appear to be recognized at any point in *Bulletin 160-98*, and the interchangeable use of these terms indicates that DWR’s methodology fails to draw the distinction. DWR’s plans contain no analysis of the actual *demand* for water at different price levels, nor does it acknowledge that use changes dramatically with price. *Bulletin 160-98* does note changes in crop types, but it does not acknowledge the water price mechanism driving many of these changes.

DWR’s methodology should be changed to include price elasticity for all uses based on real marginal prices in all sectors.

Lack of Economic Information

Feedback signals provided within market economies through price signals are important input for policy. DWR identifies issues of “affordability” and “ability to pay” problems related to new facilities, and it notes the impacts of world markets and price supports for agriculture. The analysis of supply and demand, however, fails to account for the most basic signal in markets – *price*. In a single mention of demand elasticity in the most recent *Bulletin*, DWR argues that studies have shown that price is *not* a significant factor in the urban sector.¹⁰⁸

Curiously, after rejecting the impacts of price on urban water demand, DWR then claims that in forecasting demand in the urban sector it includes “income, economic activity, *water price*, and conservation measures” in its analysis.¹⁰⁹ The claim is not supported by the actual analysis in *Bulletin 160-98*, though it is certainly the direction in which the analysis ought to proceed.

For the agricultural sector, DWR seems quite cognizant of economic impacts on agriculture *other* than water price. Subsidies through price supports, and international markets are identified.

It is important to emphasize that many factors affecting future cropped acreage are based on national (federal Farm Bill programs) or international (world export markets) circumstances. California agricultural products compete with products from other regions in the global economy, and are affected by trade policies and market conditions that reach far beyond the State’s boundaries.

The Federal Agricultural Improvement and Reform Act of 1996, for example, affects agricultural markets nationwide, by changing federal *price supports* for specified commodities. Under the terms of that act, *federal payments* to growers will be reduced by 2002.¹¹⁰

Some of the state’s most water-intensive crops are recipients of “significant price supports” including wheat, feed grains, rice, cotton, dairy products, and sugar.¹¹¹ DWR notes that reductions in crop acreage “due to urban encroachment, drainage problems in the east side San Joaquin Valley, and *a more competitive economic market* for California agricultural products” will cause a decline in grain and field crops by 631,000 acres. Higher value truck and permanent crops are forecasted to increase by 238,000 and 68,000 acres respectively.¹¹²

The California water planning process should include an analysis of water demand (in the market sense) based on full-cost pricing for all supplies and for all uses. This is not to advocate that all water *be* priced at that level, but the perpetual “gap” would be closed in economic theory at that point. Decision-makers and water managers, as well as the tax-

payers and water users, would better understand the reasons for the “gap” and the options to deal with it.

Demand-Side vs. Supply-Side Analysis

Since its inception, DWR has focused on the supply side of the water policy picture. *Bulletin 160-93* was the first state plan to recognize water demand management methods as a means of meeting water needs.¹¹³ In the most recent plan, DWR includes water-use efficiency and demand-side policies, but it presents contradictory statements. The “methodology” employed, and the inconsistent assumptions between supply-side and demand-side approaches is a serious problem. Flawed comparisons in *Bulletin 160-98* between the two approaches, coupled with its clumsy pitch for a greater DWR role in statewide supply-side project planning and development, reveal both the *serious bias* of the department and its failure to provide objective analysis.

Without a cost-effectiveness or cost/benefit analysis, DWR proclaims that “Clearly, conservation and recycling alone are not sufficient to meet California’s needs.”¹¹⁴ This assertion is not supported by empirical evidence. DWR then argues that *local agencies have failed to plan for enough* “supply augmentation options” due to “perceived implementability constraints” and “affordability” problems.¹¹⁵ Translated, the local agencies realize when the economics do not support ever more futile supply-side ventures, and they also recognize the environmental problems associated with these “engineered” options. DWR’s solution is to seek an expanded role, *with additional state funding*, to plan and process “new” supplies. It is as if DWR is still in the 1950s working on Bulletin Number 3 and unaware of the changes that have occurred in half a century.

DWR estimates that through efficiency improvements, the urban sector will provide 1.5 MAFY of supply by 2020, and agriculture will provide only about half that amount – 0.8 MAFY, by the same date.¹¹⁶ This represents a 2% improvement in efficiency in agriculture over 25 years, and a 6% increase in per capita efficiency in the urban sector.¹¹⁷ Politely put, DWR’s estimates of efficiency potential appear to be *seriously understated*.

Actual efficiency improvements, given current cost-effective technology and practice, should be significantly higher, and they should be achieved in a much shorter time frame. Some major water purveyors such as LADWP have in fact stated publicly that they plan to meet all increasing future demands through efficiency strategies and re-use alone. DWR needs to reexamine its entire analysis of efficiency improvements in all sectors if it is to provide an accurate assessment for the state.

DWR notes in *Bulletin 160-98* that current progress in the implementation of urban “best management practices” (BMPs) and agricultural “efficient water management practices” (EWMPs) has been disappointing. After over ten years of negotiations:

Presently, about half of California’s urban population is served by retailers that have signed the urban memorandum of understanding for water conservation measures. Less than one-third of California’s agricultural lands are served by agencies that have signed the corresponding agricultural MOU.

DWR assumes “a more rigorous level of implementation than water agencies are now obliged to perform,” such that all water purveyors will sign and implement the BMPs and EWMPs by 2020. The fact is that the voluntary implementation of the measures has not worked in many cases, and purveyors are not currently “obliged” to do much at all. *These are the same purveyors whose “likely plans” form the basis for the California Water Plan.* The agricultural interests spent years stalling the process, claiming that they are already *more* that 100% efficient on the odd logic that evaporation and return flows contribute *more* to the hydrologic cycle than they used in the first place.¹¹⁸ The urban purveyors insisted, from the beginning of the process, on low efficiency potential numbers. Some purveyors have done a good job in implementing efficiency improvements, even beyond the BMPs, while others have done little or nothing. Full implementation of the measures should be required immediately, not in 25 years. Furthermore, the BMPs and more so the EWMPs, should be strengthened to reflect cost-effective technical potential based on realistic marginal prices for water. The analysis should include, in addition to the marginal costs (operating and capital) of water, the costs of wastewater and agricultural drainage water treatment and/or impacts.

Multiple Benefits of Different Strategies

Bulletin 160-98 acknowledges multiple benefits derived from efficiency measures, including reduced water treatment costs and “potential reductions in fish entrainment” at diversion structures.¹¹⁹ It should also include reductions in capital and operating costs to divert or extract surface or ground water, conveyance costs, pressurization and distribution costs, and collection and treatment of the wastewater and/or agricultural drainage flows. Increased in-stream flows and environmental quality provided by reduced diversions should also be assessed. No analysis is provided that quantifies these multiple benefits of efficiency improvements and compares them to the full costs, capital and operating, of increased diversions and commensurate wastewater treatment. This type of analysis is critically needed for the state water plan in order to accurately assess the various options available.

In support of its case for new water diversions *instead* of water efficiency measures, DWR presents an argument in *Bulletin 160-98* that “new” supplies (contrasted to efficiency improvements) hold the potential for re-use which efficiency improvements do not.¹²⁰ The point DWR makes is that only 100% of efficiency improvements may be counted as “new” water, whereas *more* than 100% of new diversions may be counted if some portion of the water is reused. This is partially correct, but it fails to note the need for a full-system analysis which would include conveyance and distribution losses associated with new diversions, including evaporation and leakage at all stages of the system, and comparison of the full costs and benefits with each alternative. The argument also presumes that all current volumes of available wastewater are reused first, (which is not the case) since additional supplies of “new” water on the margin would simply increase wastewater volumes if any present supplies are going unused. Such an analysis and comparison would be useful. Once all existing sources of wastewater are being reused (presumably several times before depletion) the argument would have greater merit.

The Illogic of “Demand Hardening” as an Argument Against Efficiency

DWR argues for “additional facilities” because water “shortages” have direct and indirect costs.¹²¹ DWR fails to acknowledge that under-valued water supplies create false “demands” and that water use patterns based on artificial economic structures inflate “damage” figures. Reported “costs” including the replacement of water-intensive landscaping during droughts, are not analyzed against the full costs of new marginal supplies or against the impacts of drought on more appropriate landscapes, although DWR states that:

Agencies may evaluate the marginal costs of developing new supplies and conclude that the cost of their development exceeds that of shortages to their service areas, or exceeds the cost of implementing contingency measures such as transfers or rationing.¹²²

Translated, DWR acknowledges that it may be far more cost-effective to simply plan for drought events and recognize water scarcity than to invest in a 100% water supply-based strategy. DWR then argues that efficiency improvements *reduce* an agency’s ability to respond to drought conditions, apparently based on a “strength through exhaustion” approach. “Waste it for a dry day” would be an apt motto for DWR’s logic.

As water agencies implement increasing amounts of water conservation in the future (especially plumbing fixture changes), there will be a correspondingly lessened ability to implement short-term response actions such as rationing. Demand hardening will influence agencies’ decisions about their future mix of water management actions.¹²³

In essence, DWR is arguing that agencies and consumers should deliberately waste water with plumbing fixtures and other uses that could be more efficient. Then in a drought, they can presumably reduce the waste to some degree through rationing. This is presented as “water planning” in the official state water plan.

This lack of logic and flawed planning approach deserves comment. The presumption is that in a drought, homeowners would flush less and take shorter showers to reduce consumption. Perhaps they would also let their lawns and landscape die. By doing so,

they decrease their quality of life to get to the same level of water use they would have had if they had installed efficient plumbing devices and planted more drought-tolerant landscapes. As water supplies become short with the on-set of a drought, the water-efficient home reduces pressures of supplies while the inefficient users continue to draw more heavily on supplies to meet the same needs. Once a drought emergency is declared, the water-waster reduces use levels to the level of the efficient user. Following the drought, the water waster endures the costs of replacing landscapes that have died.

The mythology of the “demand-squishiness” argument has been around since the early 1970s, and it was tested in the late 1980s and early 1990s in the drought that DWR uses as its basis for future drought planning. It is remarkable that this “waste it for a dry day” thinking is still embodied in the state’s formal planning process.

Planning for Climate Variability

A critical factor in long-range planning for water resources is the impact of potential climate change on the state’s water systems. Changes in temperature and precipitation patterns could affect snow-pack, runoff flows, and water use critical to the state’s planning. An increase in variability of precipitation could bring extreme events such as droughts and floods, and it could mean increased incidence of fire events coupled to increased sedimentation with precipitation that follows. DWR notes that it “assumes” California’s climate will not change over the next 25 years and therefore does not include consideration of potential climate change impacts in *Bulletin 160-98*.¹²⁴ A growing body of scientific literature suggests that the state would be prudent to re-examine this omission and analyze potential implication of climate change on water systems.

Bulletin 160-93 included a side-bar on potential climate change impacts, noting the potential implications of both changing snow pack and sea level rise on water supplies.¹²⁵ With additional information available, it is unclear why DWR chose to ignore this potentially serious consideration in the 1998 study.

CONCLUSION

The Purpose of Water Supply Planning

The purpose and logic of water resources “planning” has changed dramatically since mid-century. The state faces new and complex challenges which cannot be addressed by the supply-side water development approach that prevailed in the past. Indeed, that approach has created problems that must now be remedied.

As the lead agency for state water planning, DWR has had serious difficulty adjusting to changing conditions. Through the most recent official state water plan, the department has struggled to reconcile its biases. The state planning process, and the current water plan, are seriously inadequate to serve the state’s critical interest in sound planning and management.

A Not-So-Hidden Agenda

DWR mounts a vigorous defense against the suggestion that it should have a “vision” for the state, claiming that such a vision is “not within the department’s jurisdiction.”¹²⁶ The claim is specious. DWR has always had a vision. From its inception, its vision has been bold and clear, if misguided. The department has articulated that vision through the years, much more clearly and honestly in the 1950s than at the end of the century.

To claim that it lacks “jurisdiction” to have a vision is interesting. The simple truth is that DWR’s vision for water development in California is no longer shared by the majority of society, or by a majority of its elected representatives. Moreover, the courts are increasingly rejecting elements of the DWR vision. Voters have rejected the centerpiece of the vision, the peripheral canal, and physical elements of the vision are actually being dismantled.

It is not surprising that under these circumstances DWR would use a variety of euphemisms to describe the dams and canals it wants to build, or see built. The department has correctly concluded that these “features” and “facilities” lack public support due to unjustifiable costs and impacts. But rather than undertake a realistic assessment of the state’s water options, the department has gone to considerable lengths to build a case for its obsolete vision. This is a disservice to the state and a waste of resources.

The state needs a new water planning process. With an economy of over \$1 trillion, the largest population and the largest economy in the nation, and with limited water supplies to allocate, California needs a more accurate and useful analysis of its water resources. The process must be far more transparent and inclusive than past efforts, and it should address a clearly articulated goal. Due to the serious shortcomings of *Bulletin 160-98*, the new process should be organized under a different framework than that which DWR has used to produce the plans in the past.

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² “The full solution of California’s water problems thus becomes essentially a financial and engineering problem.” Harvey O. Banks, Director of the Department of Water Resources, letter of transmittal to Governor Knight, May 6, 1957, California Department of Water Resources, Bulletin No. 3, *The California Water Plan*, May 1957, xiii.

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- California Department of Water Resources, Bulletin 3, *The California Water Plan*, May 1957.
- California Department of Water Resources, Bulletin 160-66, *Implementation of the California Water Plan*, March 1966.
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- California Department of Water Resources, Bulletin 160-74, *The California Water Plan*, November 1974.
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¹⁶ Board of Consultants, Report of the Board of Consulting Engineers, May 8, 1957, reprinted in California Department of Water Resources, Bulletin No. 3, *The California Water Plan*, May 1957, xv. (Emphasis added.)

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- ²⁶ California Department of Water Resources, Bulletin 160-70, *Water for California*, December 1970, p10.
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